ASTE JOURNAL

MAY 1932

The Tool Engineer

THE TOOL ENG

OFFICIAL PUBLICATION

On the Value of ... Research - Its Appl... to Manufac...
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Designing for Eff...
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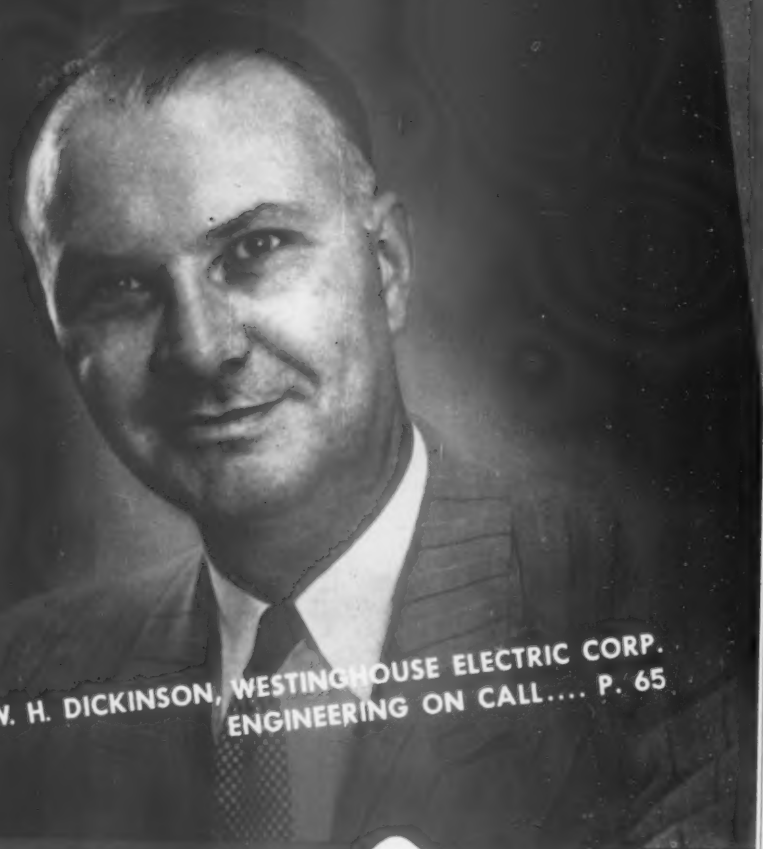


The Tool Engineer

20TH ANNIVERSARY

W. H. DICKINSON, WESTINGHOUSE ELECTRIC CORP. ENGINEERING ON CALL.... P. 65

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

OCTOBER, 1952

VOLUME XXIV, NO. 4

Here's How Heald versatility solved twelve borizing problems at once

One Single-station Heald Bore-Matic permits precision borizing of

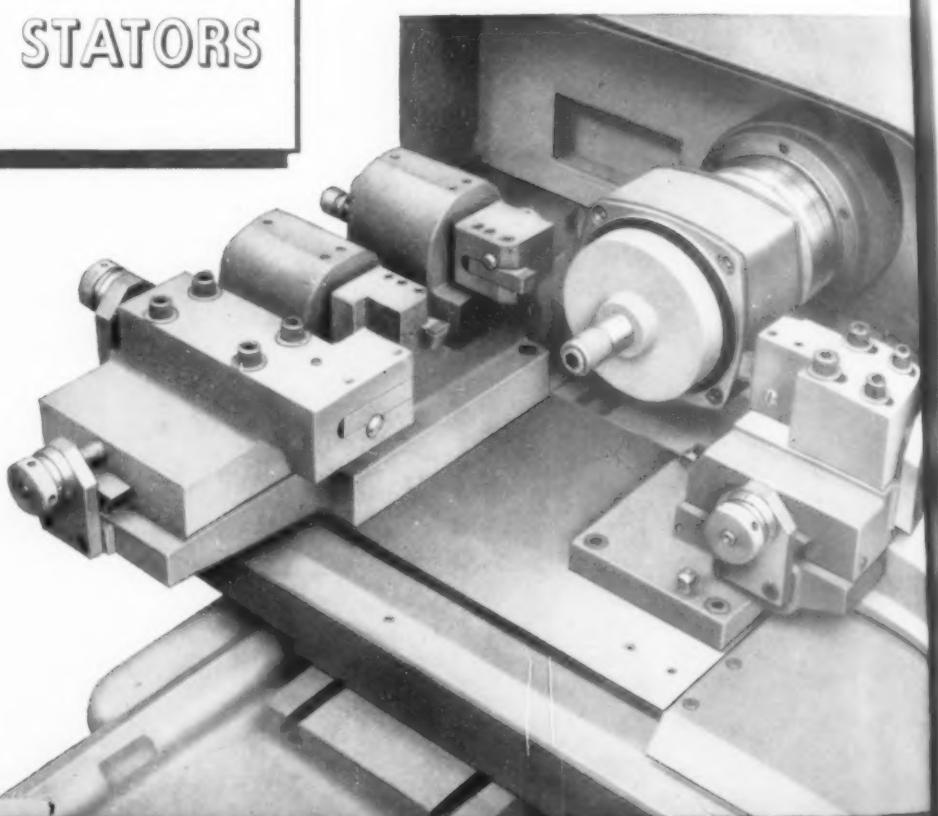
12

DIFFERENT SIZE MOTOR STATORS

• Where high production is required on a variety of different size parts, the extra versatility of a Heald Bore-Matic pays big dividends in time and effort saved.

Take the Model 321 machine shown below, for example. This boringhead and tool block set-up accommodates 12 different sizes of motor stators, for chamfering, turning and facing rabbet diameters. Interchangeable workholding adapters, adjustable tooling and flexible drive arrangement permit this unusual economy of equipment for such a diversified application. Work is located on stake fixtures from the I.D. of the laminations and against the adjacent face. A chip shield prevents metal particles from getting into the windings.

Remember—when it comes to precision finishing, it pays to come to Heald.



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Heald machines speed the nation's production

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VOLUME XVIII
NUMBER 4
OCTOBER 1952

The Tool Engineer

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MERICAN SOCIETY OF TOOL ENGINEERS

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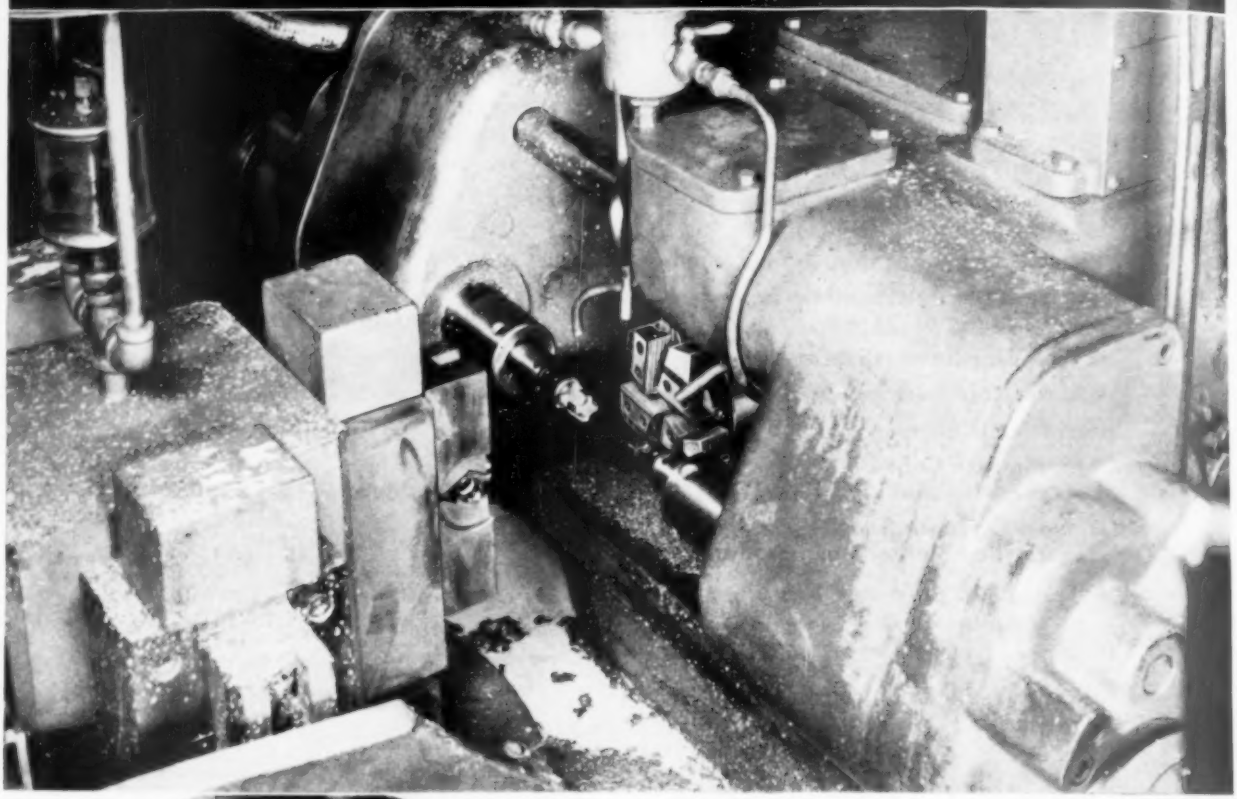
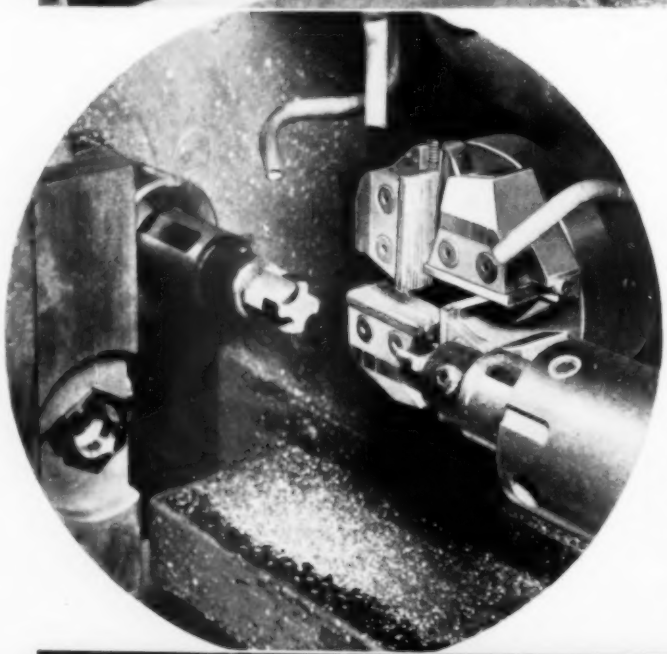
57% Less Threading Cost
ON AUTOMATIC CHUCKING MACHINE





A *LANDIS* Solid Adjustable Die Head cut the cost of one threading operation in the plant of a large Middle Western manufacturer by 57%.

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The *LANDIS* Head fit perfectly into the highspeed cycle of the chucking machine, and produced an average of 210 finished pieces per hour, revolving at 385 RPM. Major factors in the efficiency of this *LANDIS* Head were low down-time and low tool cost, occasioned by long tool life. Output of finished pieces averaged from 4,000 to 5,000 between chaser grindings.

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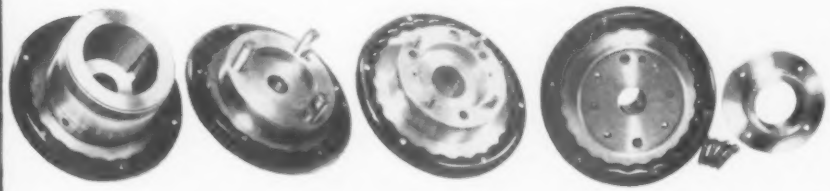
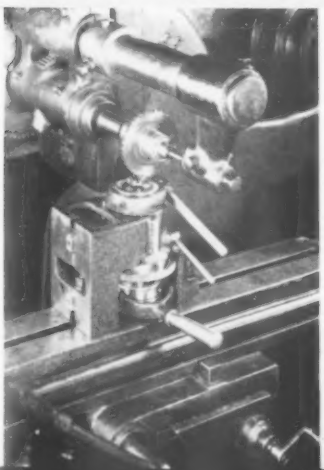
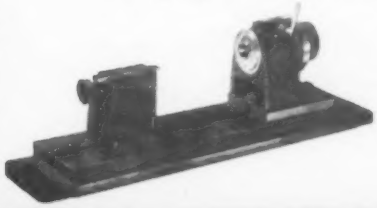




HARDINGE COLLET INDEX FIXTURES

The way to increased production is to hold work accurately and provide for rapid indexing. HARDINGE Collet Index Fixtures—H-4 for Tool Room and Inspection Departments; HV-4 for Production Departments—will help increase production on either new or old machines. Planned interchangeability for a variety of applications. Buy these standard fixtures instead of making expensive special fixtures



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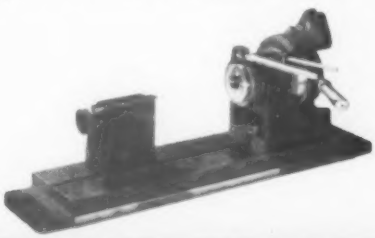

HV-4

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"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Latrobe to Display Mammoth Bar of High Speed Steel

New Development to be Featured at A. S. M. Show

Latrobe Steel Company, well known producers of quality tool steels, will exhibit at the Philadelphia A. S. M. Exposition (October 20-24) a bar of "DESEGATIZED" high speed steel — 10 inches in diameter and 10 feet long, weighing approximately 3,000 pounds.

This is the largest bar of high speed steel ever made and is free of carbide segregation throughout.

Carbide segregation and its harmful effects have long been a problem in the manufacture and heat treatment of high alloy tool steels. Latrobe Steel Company, who introduced "DESEGATIZED" high speed steels and high carbon-high chromium die steels in 1946, states that it is now possible to manufacture sizes free of carbide segregation to meet any current and foreseeable needs for these steels.

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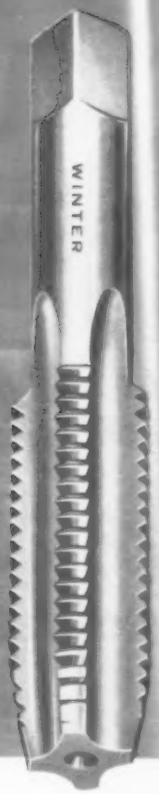
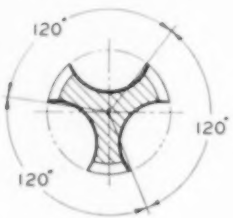
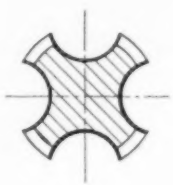
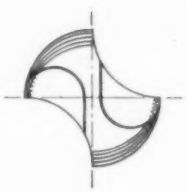


Exact Flute Spacing



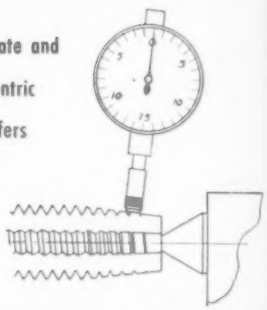
Uniform Flute Contours





Precision Chip Driver Contours

Accurate and Concentric Chamfers



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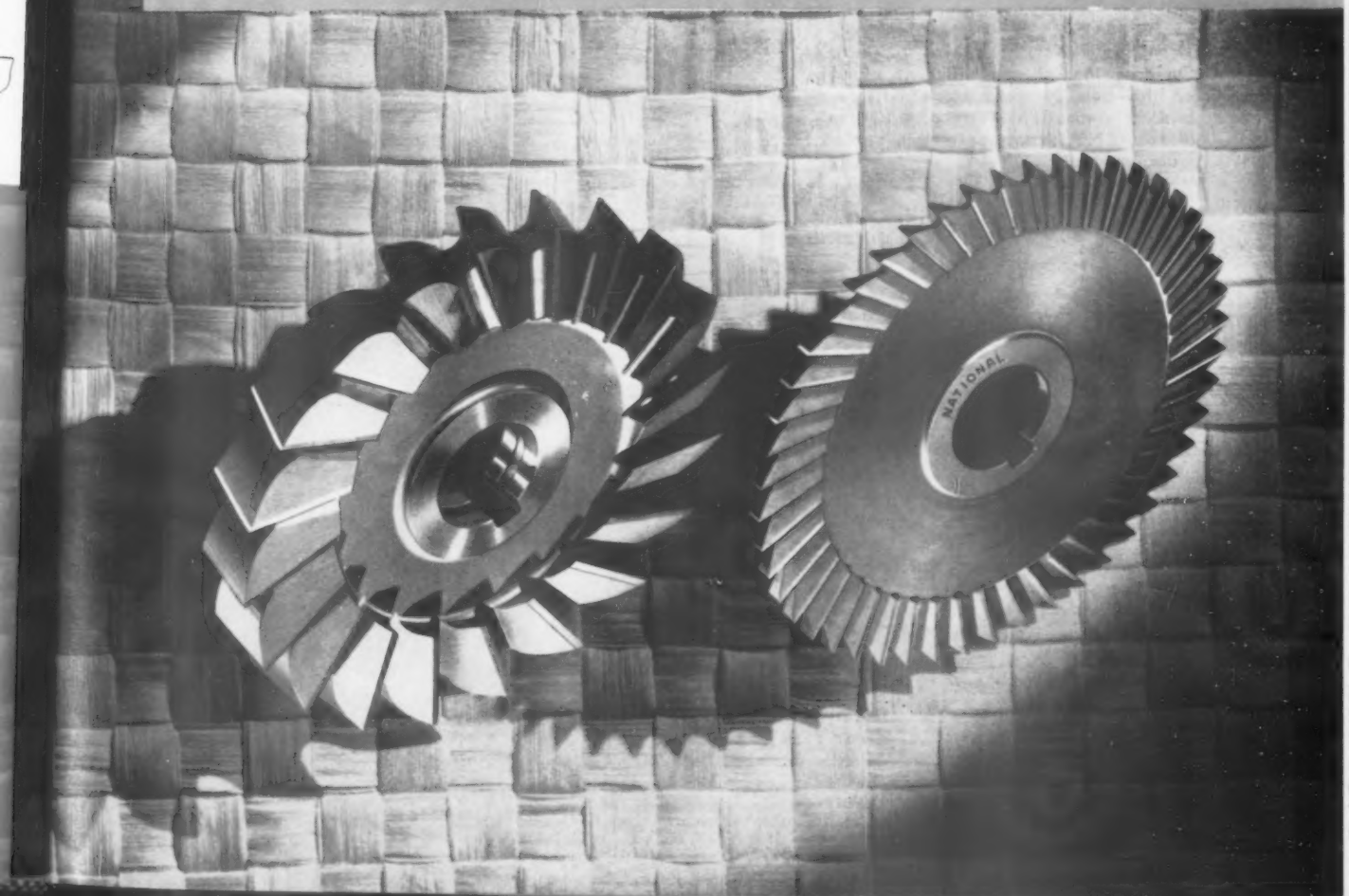


MACHINE ALL SORTS OF

Economically

WITH

PRATT & WHITNEY VERTICAL SHAPERS

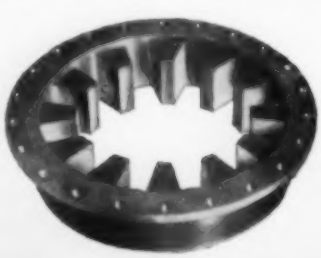
Rotary feed to the table made it easy for a P & W Vertical Shaper to machine the three cylindrical surfaces indicated by arrows. Thus, no expensive fixtures were required.

Surfaces in fourteen different planes on this box jig were finished rapidly and economically with a P & W Vertical Shaper. No changes in this set-up were needed.

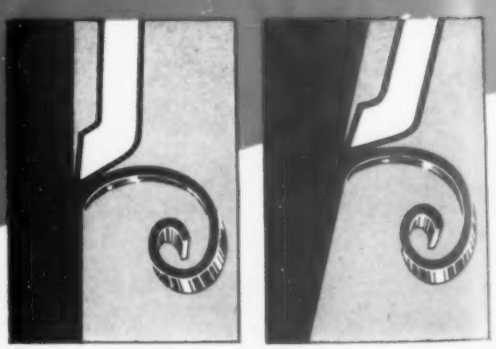
- INCREASED STRENGTH
- PERMANENT ACCURACY
- FEWER SET-UP CHANGES
- FEWER SPECIAL JIGS and FIXTURES
- BETTER VISIBILITY
- POWER ROTARY FEED to the TABLE
- EASY, ACCURATE INDEXING
- CONVENIENT CONTROLS
- HEAVY CUTTING and FINE PRECISION

"The Handiest Machine in Your Shop"

Producing this die set—including die, die shoe, punch and stripper—required the machining of intricate outlines and many sharp corners. A Pratt & Whitney Vertical Shaper did the job easily and with substantial time savings.

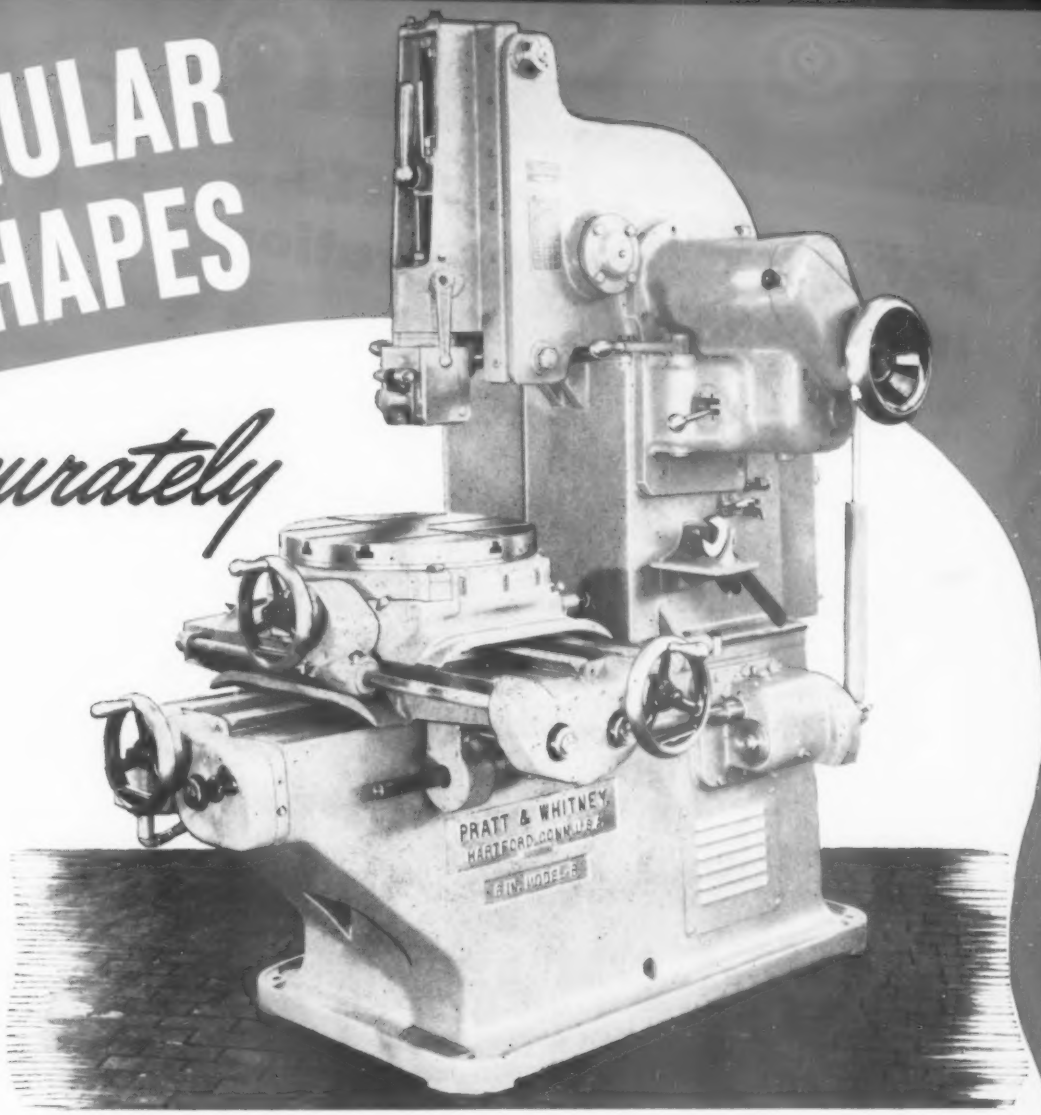


This nickel steel, twelve tooth, flexible clutch for a reduction gear mechanism has an outside diameter of 3 4⅛". The teeth were machined to .001" accuracy on a P & W Vertical Shaper.



IRREGULAR SHAPES

. Accurately



Model B
TWO SIZES
6" RAM STROKE
12" RAM STROKE

Versatile, powerful and accurate, Pratt & Whitney Vertical Shapers efficiently handle a wide variety of irregular shapes that cannot be machined conveniently or economically by any other method. P & W vertical design — with all cutting pressures taken directly on the table and bed — eliminates springing and assures permanent accuracy. The cutting action tends to hold the work in place. This feature — plus the built-in rotary table with power feed — makes mounting and indexing easy. Intricate forms can readily be machined without costly set-up changes, and expensive jigs and fixtures are practically eliminated.

Pratt & Whitney Model B Vertical Shapers are made in two sizes; 6" ram stroke and 12" ram stroke. A wide range of work sizes can be accommodated. In the die shop, tool room, for general repair work — and everywhere that irregular shapes are handled — P & W Vertical Shapers will do your difficult jobs faster and at lower costs.

Write on your Company letterhead for Circular No. 423-8

NATIONAL MACHINE TOOL BUILDERS' ASSN. 1902 1952 50th ANNIVERSARY

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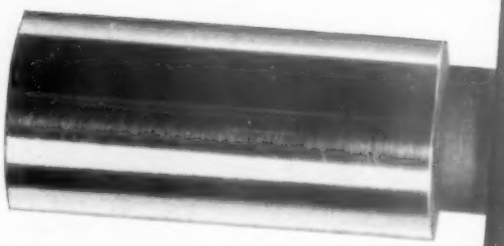
CUTTING TOOLS • GAGES • MACHINE TOOLS

how SURFACE DEFECTS impair bearing operation

No matter how smooth a ground surface may appear, examination will reveal imperfections in the form of grinder scratches and ridges, feed spirals, chatter marks and partially loosened metal splinters. Upon contact, these minute peaks and ripples interlock with the mating surface of the bearing, tending to rupture the protective oil film. Fragmented metal is torn from surfaces to mix with lubricant and cause abrasive wear, increasing clearance dimensions and shortening life. Photo at right shows an example of a scratched and galled surface which stopped rotation by "plowing" metal.

how SUPERFINISH insures bearing life

Superfinish removes all surface defects such as grit scratches, feed spirals and the soft "smear metal" caused by grinding heat, and having removed the faulty layer—gets down to metal of the desired structure and hardness. At the same time, it produces a more nearly perfect geometrical form which supports a more efficient oil film for lubrication. There are no projecting defects to churn the oil film or cause metallic contact.



Load carrying capacity is substantially increased by Superfinishing. And bearing life is greatly prolonged.

you should know the facts about SUPERFINISHING!

It may surprise you to know what a quick and inexpensive process Superfinishing really is. It can greatly reduce the cost of grinding and, in many cases, eliminate such expensive operations as hand lapping and polishing.

If you have not yet read the booklet "Wear and Surface Finish," we will be glad to send you a copy of this authoritative text book with our compliments. Please request it on your company letterhead.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*

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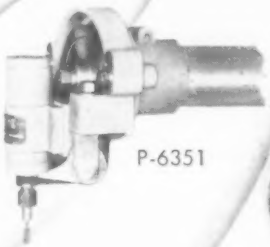
IT'S THE SPINDLE THAT DOES THE WORK

P-2641



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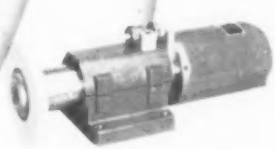

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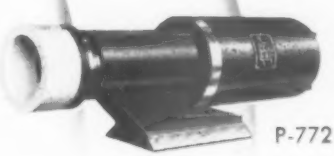

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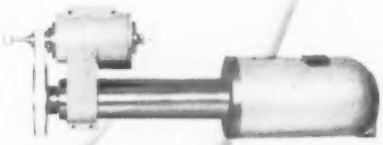

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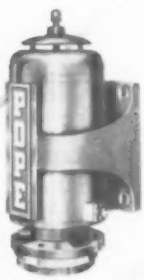

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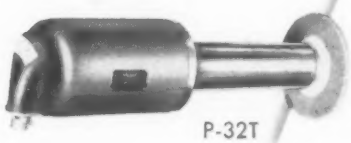

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P-274

Both the QUALITY and the QUANTITY of a machine's production largely depends on the SPINDLE. For trouble-free operation and continuous production of accurate parts *Specify* POPE SPINDLES.

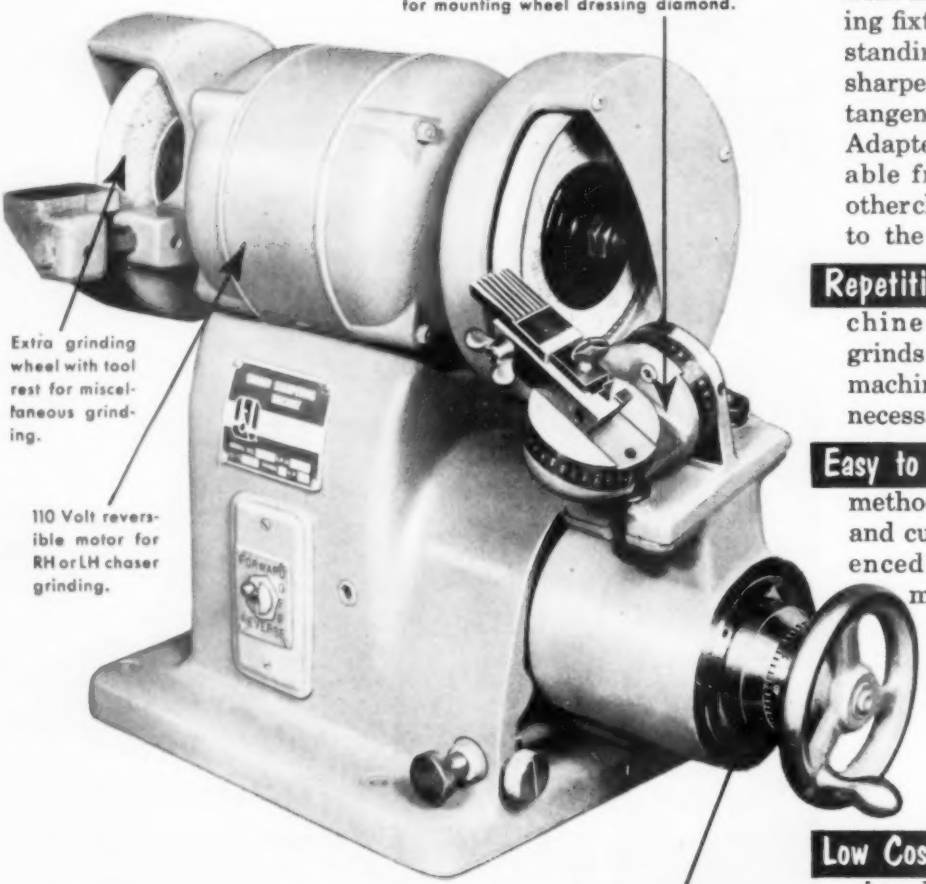
No. 88

Specify **POPE®** PRECISION SPINDLES

POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET · HAVERHILL, MASSACHUSETTS

JONES & LAMSON
UNIVERSAL BENCH TYPE
CHASER SHARPENING MACHINE

Specifically designed to resharpen chasers, this *Low Cost,* space saving machine allows you to free heavy expensive machine tools for their intended uses, and at the same time do a better job of chaser sharpening. *It's good for miscellaneous small tool and cutter grinding too.*


J & L Universal Grinding Fixture with tangent chaser. Basic fixture has provision for mounting wheel dressing diamond.
Extra grinding wheel with tool rest for miscellaneous grinding.
110 Volt reversible motor for RH or LH chaser grinding.
Graduated micrometer dial to control infeed.

Grinder set up to resharpen J & L Tangent chasers

Universal Application Equipped with the new J & L chaser grinding fixture and adapters, an outstanding job will be done on all sharpening operations, for both tangent and radial die chasers. Adapters for J & L chasers available from stock. Adapters for other chasers can easily be applied to the chaser grinding fixture.

Repetitive Accuracy This machine will duplicate desired grinds repeatedly. It is a precision machine tool equipped with all necessary stops and controls.

Easy to Operate Simple, direct methods speed up the operation and cut costs. Even an inexperienced operator can, in a few minutes, learn to resharpen chasers on this machine.

Saves Space BENCH SPACE 14 x 28 inches is ample for your complete chaser resharpening operation.

Low Cost This complete unit, designed to do your entire chaser resharpening job, sells for only a small fraction of the cost of other bulkier machines often used. Why not install one in your plant, and release your heavier, bulkier machines for their intended uses?

P.S. *Because of its size this machine can well be a time saver in shops where cutter grinding rooms are at distant points from the machines where dies are used. Write Dept. 710G for further details.*

JONES & LAMSON

Machine Tool Craftsmen Since 1835

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Correct MISALIGNMENT
with the ERICKSON FULL FLOATING HOLDER

MODEL 189
COLLET TYPE
(illustrated)
gives both
PARALLEL ADJUSTMENT
and ANGULAR ADJUSTMENT

With the Full Floating Holder, another of the Erickson family of Precision Holding Tools, work and cutting tools may be quickly and easily adjusted to offset machine errors.

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DIVISION OF THE ERICKSON STEEL COMPANY
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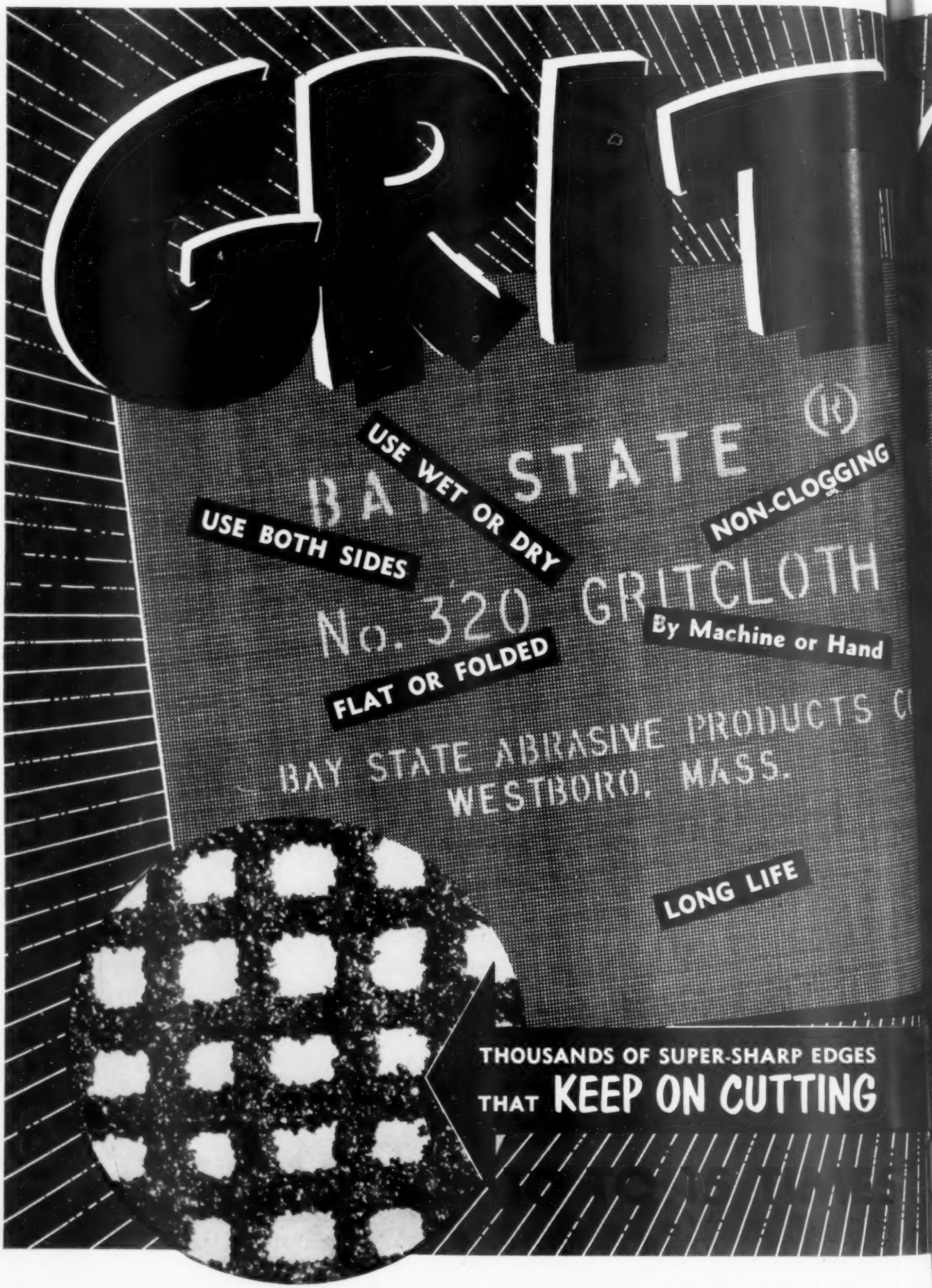
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*All are Genuine Tool Steels

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SEE THIS NEW PRODUCT AT MILNE'S BOOTH NO. 506 — NATIONAL METAL EXPOSITION — OCT. 20-24 — PHILADELPHIA

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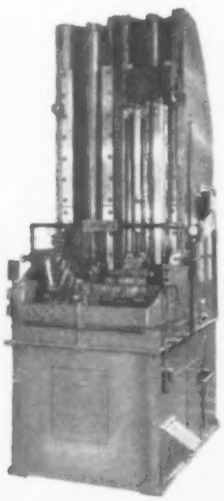

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Full information is available in our illustrated circular on Lapointe Double Ram Vertical Broaching Machines. Write for Bulletin DRV-5.

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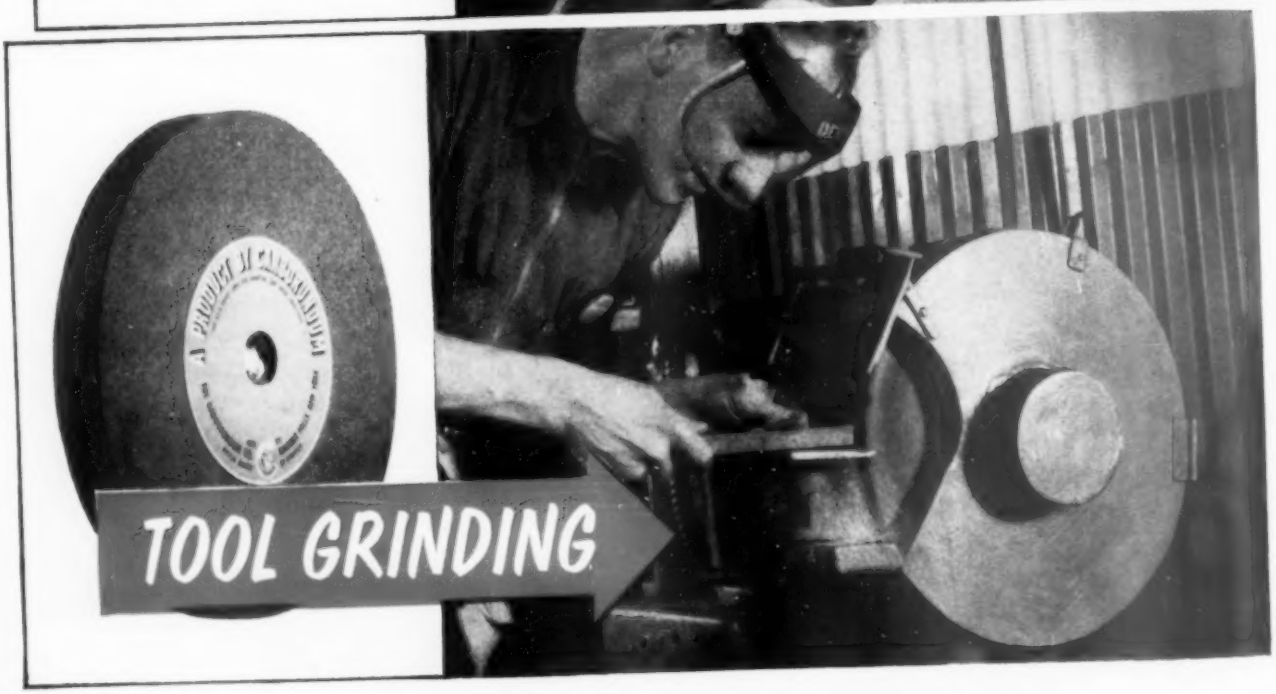

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ORDER FROM YOUR CARBORUNDUM DISTRIBUTOR TODAY. He's your best bet for complete stocks, prompt delivery, experienced counsel on latest developments in the field. You'll find him listed in the yellow pages under "Abrasives." Phone him today—it's to your profit!

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Please send me, FREE, your booklet, "Causes and Correction of Common Grinding Errors."

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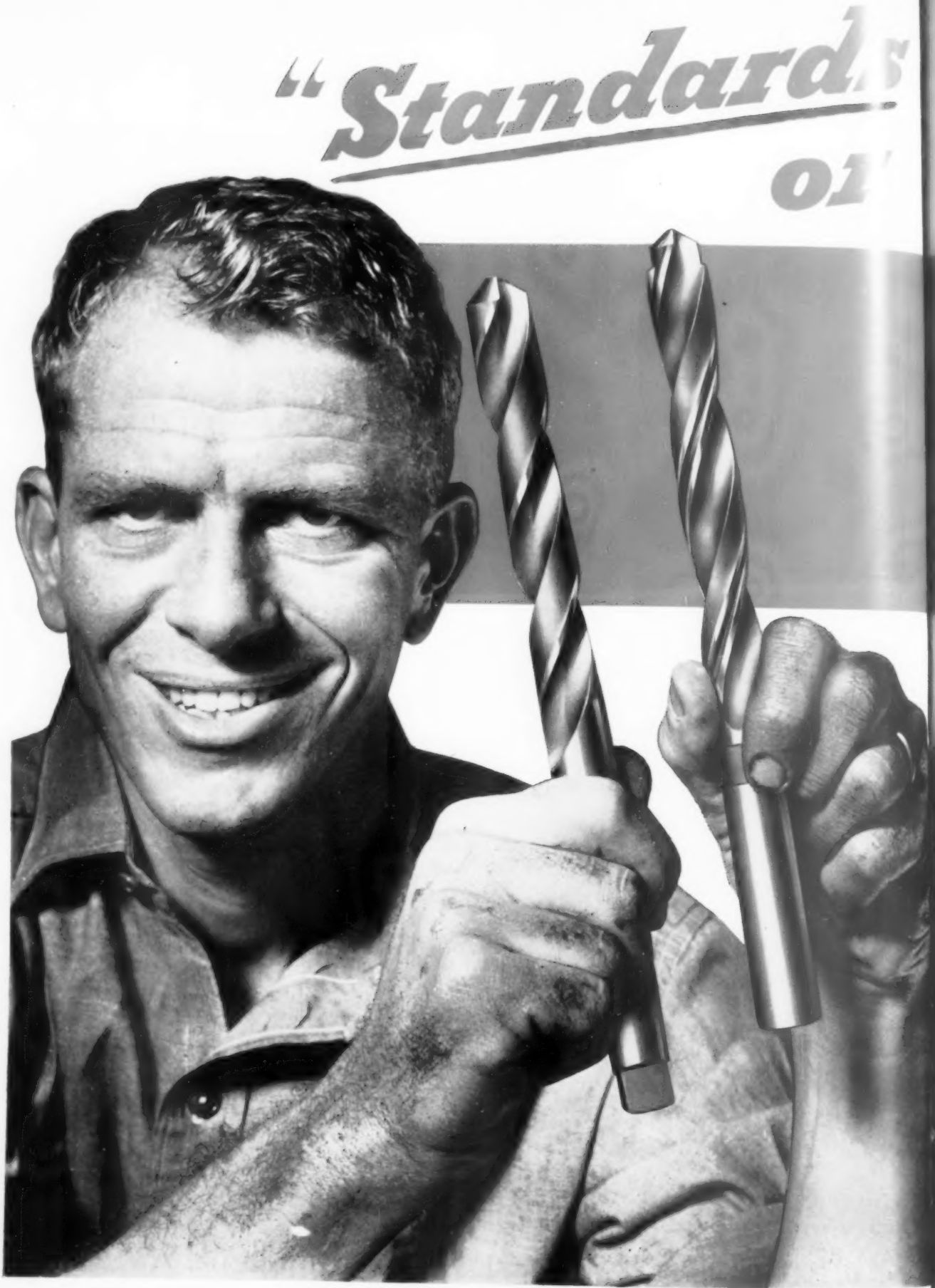
offers ALL abrasive products...to give you the proper ONE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MAKE MINE MORSE
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Whether it's a run-of-the-mill production job ... or a cranky piece of work in non-ferrous or plastics ... production men *who know the score,* know that Morse Drills score highest on *any* job ... both in clean-cut, accurate work, and in number of holes per grind.

Then, of course, if you're shooting for *extra* high score, tell your Morse-Franchised Distributor to give you Morse *ELECTROLIZED.*

It's good business to keep in touch with your Morse-Franchised Distributor as a matter of course. He has the complete stock, the seasoned know-how, and the established capacity for service that makes him *your standby* on any problem involving drills—and any other cutting tool in the complete Morse Line.

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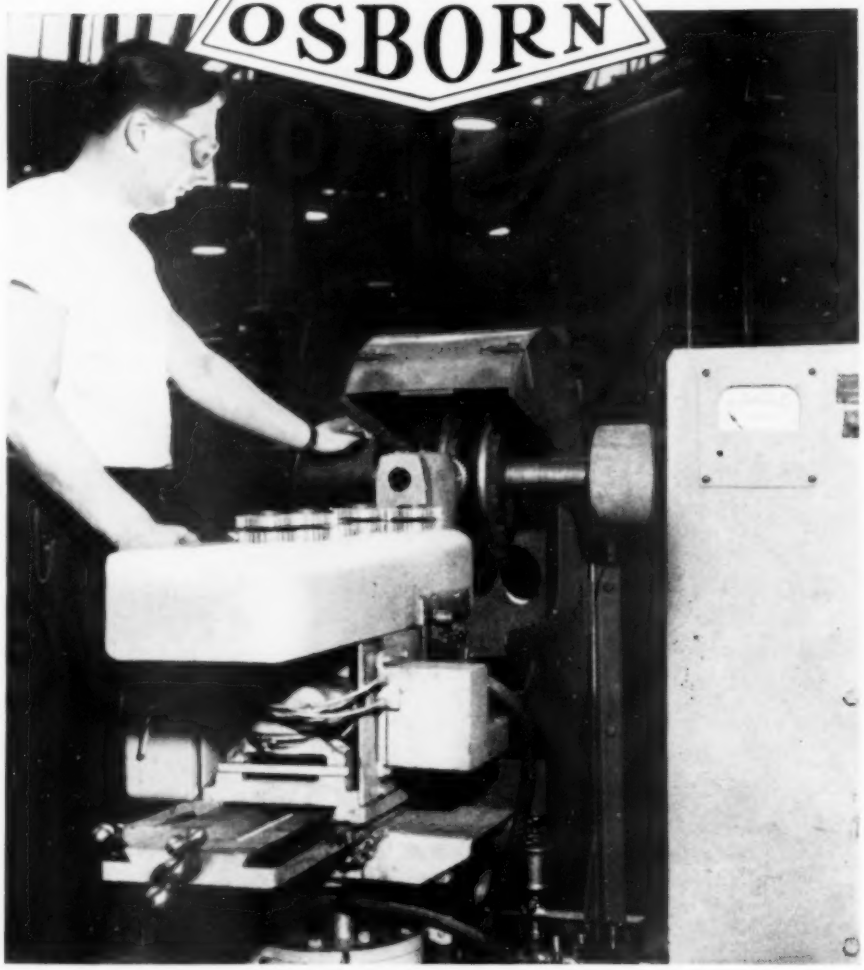


Formerly 20... now deburrs 125 per hour

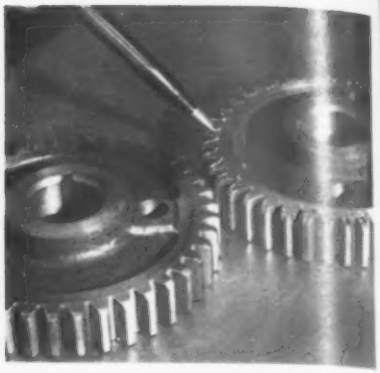
A new machine . . . the Osborn Work Holder Brushing Lathe . . . now deburrs gears and similar parts *at the push of a button!*

In the plant of Caterpillar Tractor Co., this automatic machine deburrs and finishes gear teeth *six times as fast* as the former hand method. Production now is 125 gears per hour. Output formerly was 20. Burrs and sharp edges are now removed uniformly. Every gear tooth has smooth, rounded edges and surfaces are blended.

Find out how you can speed deburring and improve product quality with this versatile Osborn machine. Call your **O**sborn **B**rushing **A**nalyst today or write *The Osborn Manufacturing Company, Dept. 841, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

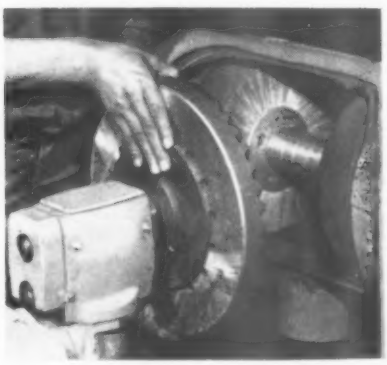
Osborn Brushes

OSBORN POWER, MAINTENANCE AND PAINT BRUSHES AND FOUNDRY MOLDING MACHINES



RESULTS ARE UNIFORM. Burrs and sharp edges are removed uniformly. Every gear has smooth, uniform, rounded edges. Surfaces are blended. These gears were deburred on the machine shown at the left.

SET-UP IS SIMPLE. The machine is highly adaptable where production involves either large runs of a few parts or small runs of many different types and sizes of gears. Machine setups may be quickly made by unskilled operators. The complete brushing cycle is controlled automatically by the electronic timer which is set for any desired brushing interval to suit the size, shape or condition of part being brushed.

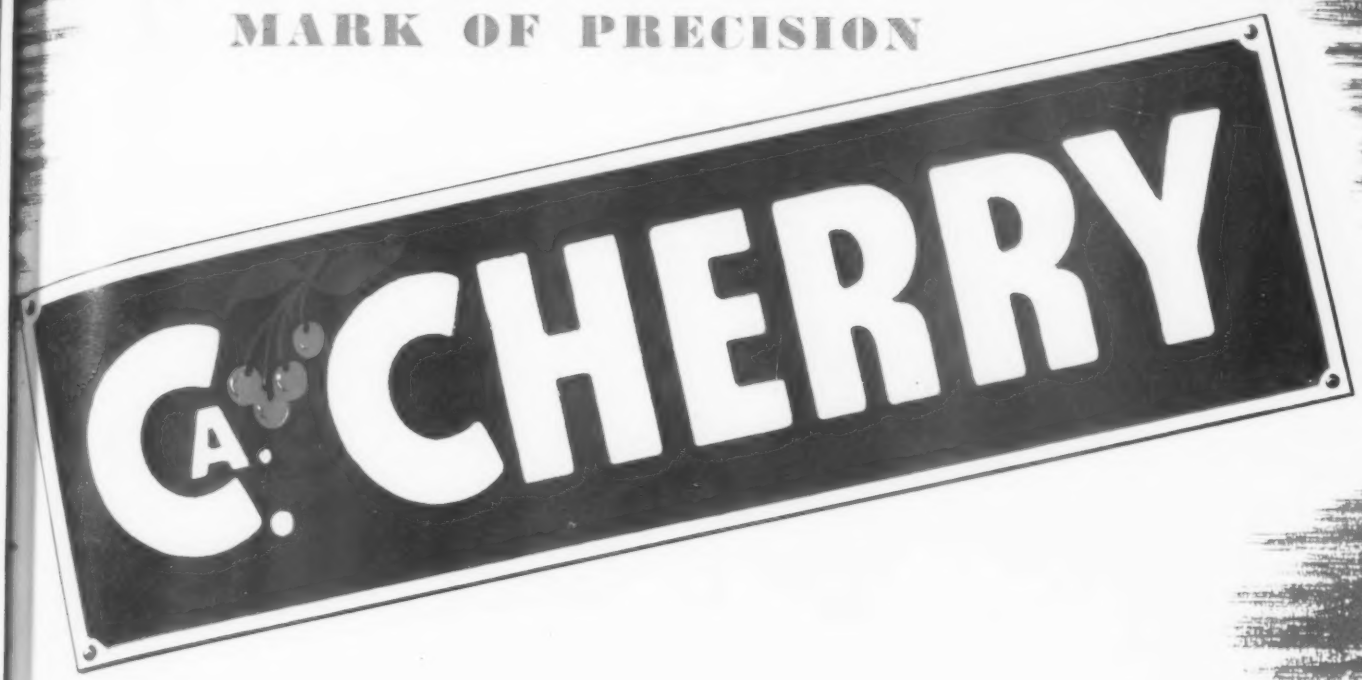


OPERATION IS SPEEDY. The operator mounts the gear easily and quickly. The gear advances to the face of two rotating Osborn brushes and the edge of the gear teeth makes contact with the brushes. To assure fast, positive action on each piece brushed, an automatic control reverses the direction of brush rotation on every cycle of operation. This machine deburrs 14-inch hypoid gears in 1½ minutes compared to 25 minutes for former method.

INVESTIGATE IT TODAY

for *your* problems. Users report time savings ranging from 20% to 1570% with the Osborn Work Holder Brushing Lathe. Let us demonstrate what it can do for you!

WATCH FOR THIS
MARK OF PRECISION



On Special Purpose Machinery

In the field of precision production—the new nameplate of Charles A. Cherry, Inc.—affixed to special purpose machinery, identifies a new service from original design to completed, custom-built production tools. Many companies faced with multiple production operations, requiring controlled accuracy, are turning to Cherry for the answer to their individual problems.

Call Cherry for Action

TEXAS 4-1992

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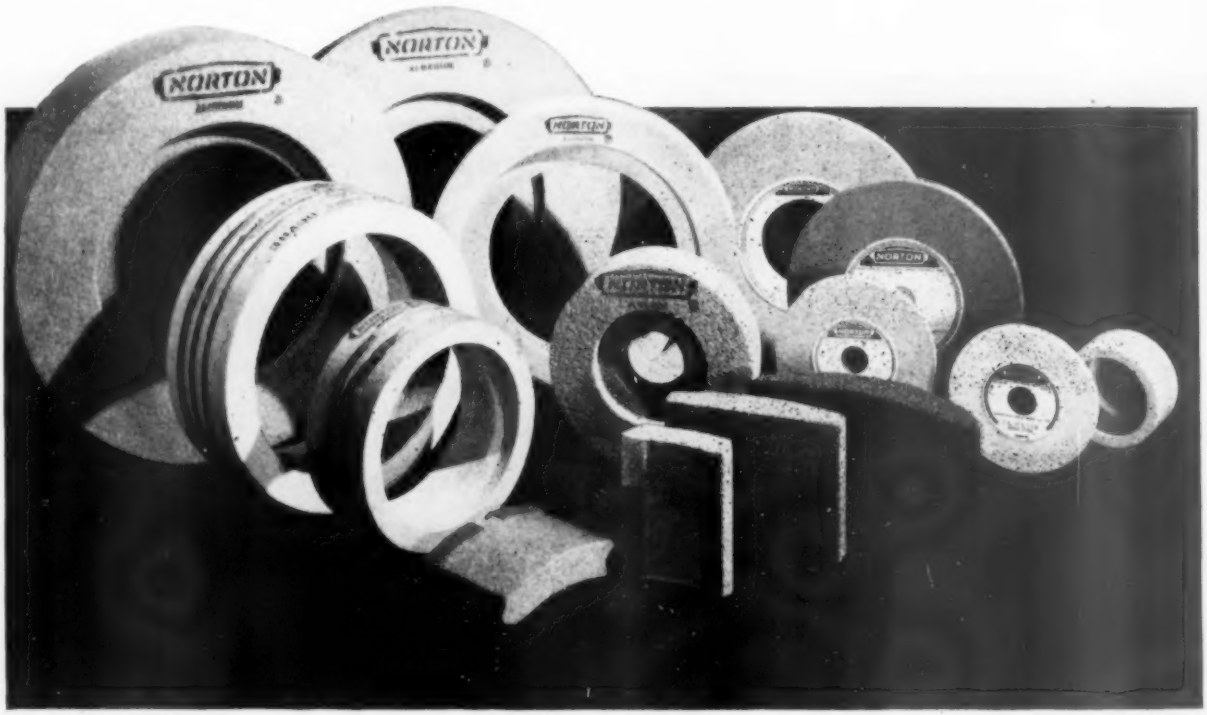
Designers and Builders

OF MACHINERY, TOOLS, JIGS & FIXTURES

PREPARED BY GRANT ADVERTISING, INC.

For more efficient surface grinding at lower cost you have a wide choice of

Norton wheels, cylinders, segments



Choose Norton ALUNDUM* abrasives for surface grinding steels of all kinds, including the hard stainless steels, annealed malleable iron and the tough bronzes. The exclusive Norton 32 ALUNDUM abrasive is first choice in solid wheels or segments, particularly where rapid stock removal is an important factor.

Choose Norton CRYSTOLON* abrasives for surface grinding cast iron, chilled iron, #300 series stainless steel, nonferrous metals, nonmetallic materials, rubber and hard facing alloys.

Norton Bonds for surface grinding include vitrified, silicate and resinoid with the special "BE" vitrified bond for use with Norton ALUNDUM abrasives.

SEE YOUR NORTON DISTRIBUTOR

For the right abrasive, the *right* bond, the *right* structure for your surface grinding jobs, see your Norton Distributor. He will work directly with you, calling in a Norton Abrasive Engineer if necessary. Ask him, too, for your copy of the brand new Booklet 1632 — "The ABC of Surface Grinding" — or write us direct.

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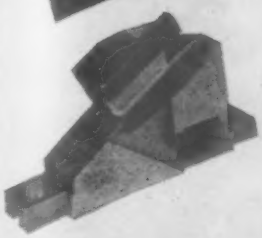
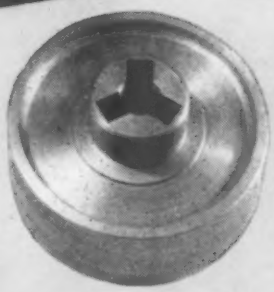
Making better products to make other products better

Outstanding ACCURACY is necessary...

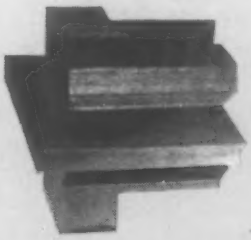
TO PRODUCE THESE *top quality products*



Slots, angles and compound angles are shaped to 0.001" limits on these solid 3140 forged steel tool holders.

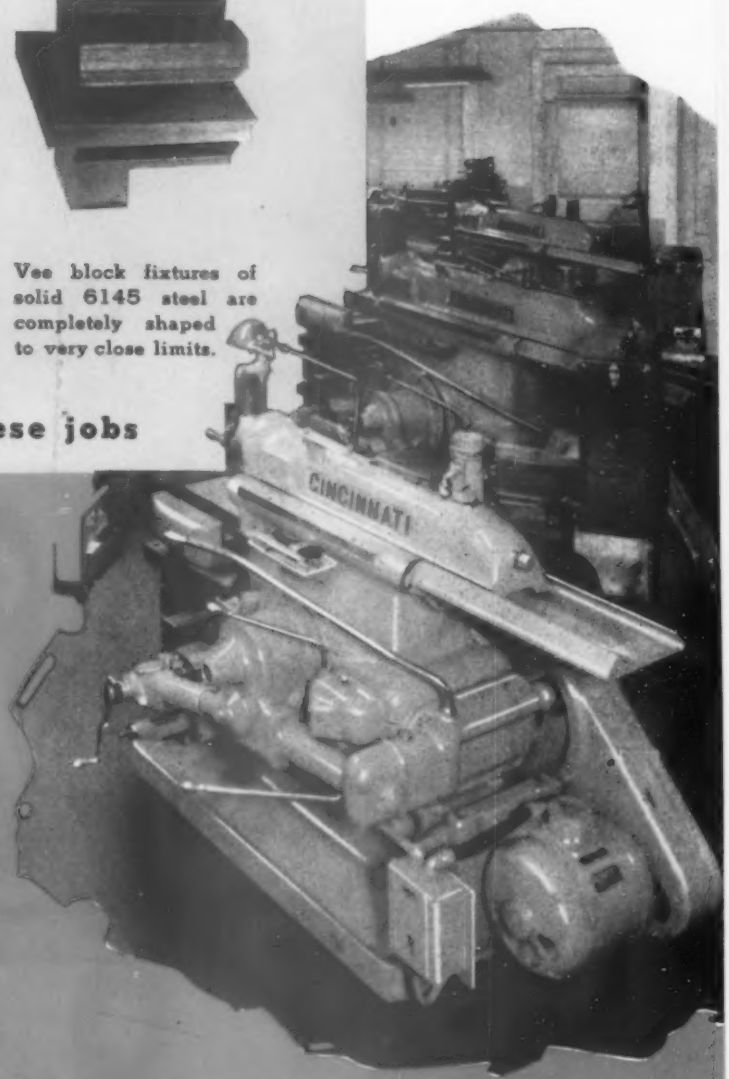


Special index heads have slots accurate in shape, size, spacing and angularity to 0.001" on all dimensions.



Vee block fixtures of solid 6145 steel are completely shaped to very close limits.

Cincinnati Shapers do these jobs



The Jordan Specialty Company . . . Shaping Specialists . . . use Cincinnati Shapers exclusively. Outstanding accuracy and versatility in production are obtained in connection with low machine investment and low tooling costs. Due to the great variety of work produced, changes from part to part must be done with minimum loss of time. Here, Cincinnati Shapers give an exceedingly profitable and outstandingly accurate performance.

Write for Shaper Catalog No. N-5 covering the complete Cincinnati line.

Photos—courtesy Jordan Specialty Company, Detroit, Michigan

CINCINNATI

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CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

Outstanding ACCURACY

TO PRODUCE

Modern Steel Kitchen

Hospital Sterilizer

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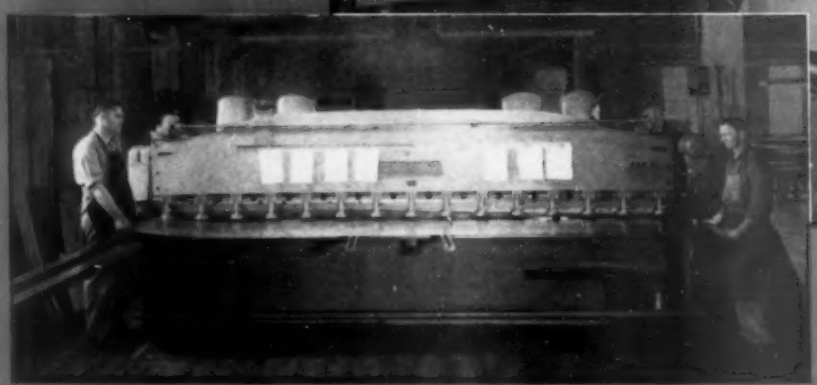
Special Stove

Photos—courtesy Jamestown Metal Products Inc., Jamestown, N. Y.

Three Cincinnati All-Steel Shears at Jamestown Metal Products Inc.



1814 Cincinnati All-Steel Shear with hydraulic holddowns, squaring arm and front controlled power back gauge.

is necessary...

THESE TOP QUALITY PRODUCTS

ACCURATE SHEARING

Jamestown Metal Products Inc. produces quality stainless steel equipment for hospital and home. Exact manufacturing standards are maintained.

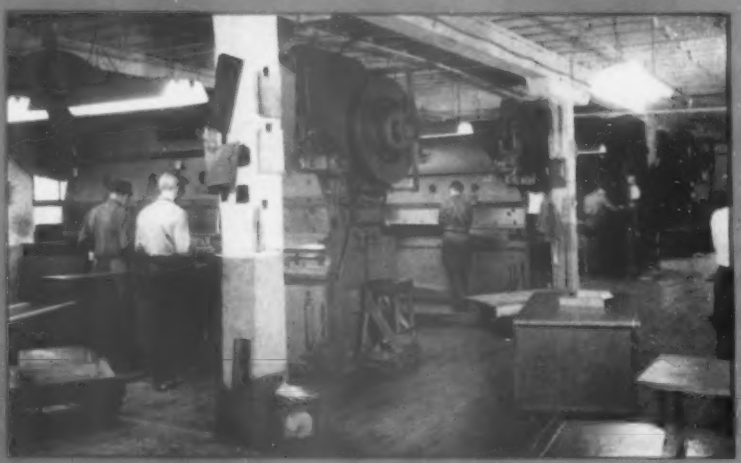
Cincinnati Shears cut blanks accurately and to size for this equipment. Gauging must be rapid as well as accurate to handle the many different sizes required and keep production costs low.

ACCURATE FORMING

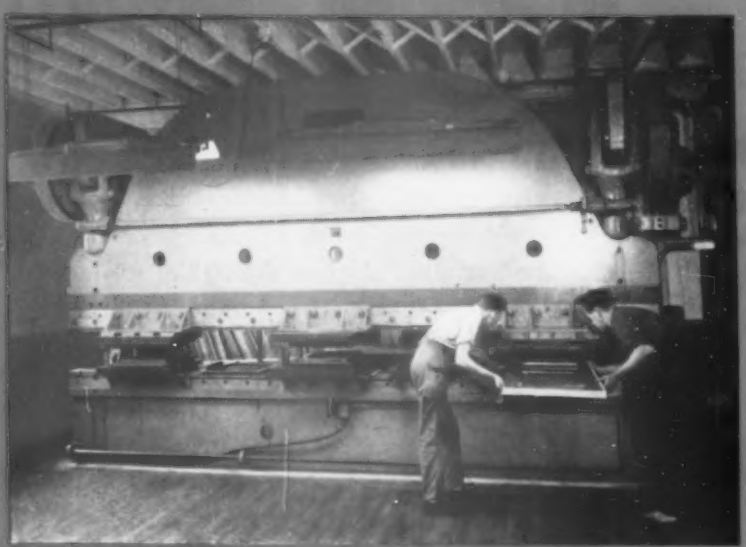
Cincinnati Press Brakes form these blanks into accurate parts that fit correctly and insure outstanding quality in the finished products as well as maintaining low assembly costs.

You, too, can expect true blanks and accurately formed parts from this profitable team of Cincinnati Shears and Cincinnati Press Brakes.

Write for Catalogs S-6 and B-3, illustrating and describing these machines.



A row of Cincinnati All-Steel Press Brakes used in the production of these quality products



A 130 x 14′ Cincinnati All-Steel Press Brake 14′ 6″ between housings tooled for multiple operations

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI

Here's an eight year old story we can tell NOW!

SAVED (IN 1944)

36,000,000 Pounds of Steel

* * *

1,296,000 Dollars

with TOCCO* Induction Heating

● In 1944 the Army Chemical Corps called for 24 million bomb noses of a certain type. Current techniques required 84 million pounds of steel and more automatic screw machines than could possibly be made available.

● Edgewood Arsenal, given the task of solving this vital production puzzle, abandoned conventional machining methods and employed a hot extrusion process—using TOCCO Induction Heating to bring 2 pound steel blanks to forging heat. *Former methods required 3½ pound blanks to produce the same bomb noses.*

60 KW, 10,000 cycle TOCCO machine heating steel blanks for extrusion into bomb noses.

● In addition to vast savings in steel and money, the new shells had superior fragmentation properties. But above all the 1944 schedule was met *—enough and on time* to strike a telling blow for victory in World War II.

THE OHIO CRANKSHAFT COMPANY • CLEVELAND 1, OHIO

TOCCO

*Trade Mark Reg. U. S. Pat. Off.

Induction Heating Equipment must meet the requirements of the Federal Communication Commission's Rules and Regulations Relating to Industrial, Scientific and Medical Services, Part 18. All TOCCO equipment is certified to comply with these rules and regulations.

The Tool Engineer

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Editorial

The Challenge of Survival!

All phases of engineering are becoming involved in fields outside of our interpretations of things strictly engineering.

Since World War I, the various branches of the Government have become tremendously interested and active in the manifold stages of engineering. With the advent of the atomic energy program, an almost incomprehensible era of engineering activity has been created.

It is only fair to state that the profession has done a good job in keeping pace with the technological advances; however, the individual engineer has a stake in other aspects of the broad overall program, and here he stands—as a lost child in the wilderness.

Because of the Government's ever-broadening encirclement of those activities heretofore operated by private capital, the engineer's point of view must also be enlarged. This broadened outlook on the part of the individual engineer must encompass a greater appreciation of things political.

Men serving our Government today not alone have greater responsibility than ever before, but they have a completely different kind of responsibility. The vast programs under Government control—power development, atomic energy, the guided missile, the hydrogen bomb—present technological problems beyond the comprehension of many a good engineer. How, then, can the average politician—as we have known them through the years—cope with these problems?

So that there can be no misunderstanding, we are not appraising the rights or wrongs of any political party, but we definitely go on record to the effect that engineers must become more interested in government. This interest must go further than vocal expression—engineers must look forward to taking an active part in government.

With perhaps the very survival of our nation dependent upon technological developments, the very best of engineering talent will be challenged as never before. We must not alone meet this challenge, we must look beyond into what the future may bring.

L. B. Bellamy

PRESIDENT
1952-1953

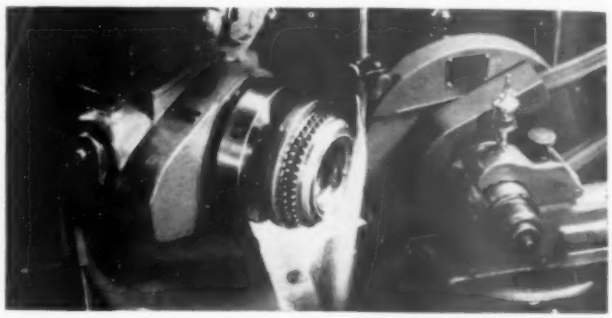
S.E.C.O. SPEEDS MACHINING OPERATIONS, REDUCES REJECTS, INCREASES TOOL LIFE

For any machining operation where an oil of its type can be used, Sunoco Emulsifying Cutting Oil will boost production, reduce downtime for cleaning and tool dressing.

A self-emulsifying petroleum product, S.E.C.O. forms a stable white emulsion when mixed with water. Its cooling and lubricating qualities make it particularly effective in the high-speed precision machining of ferrous and nonferrous metals. S.E.C.O. keeps machines clean, has a pleasant odor, and prevents rusting of parts between operations.

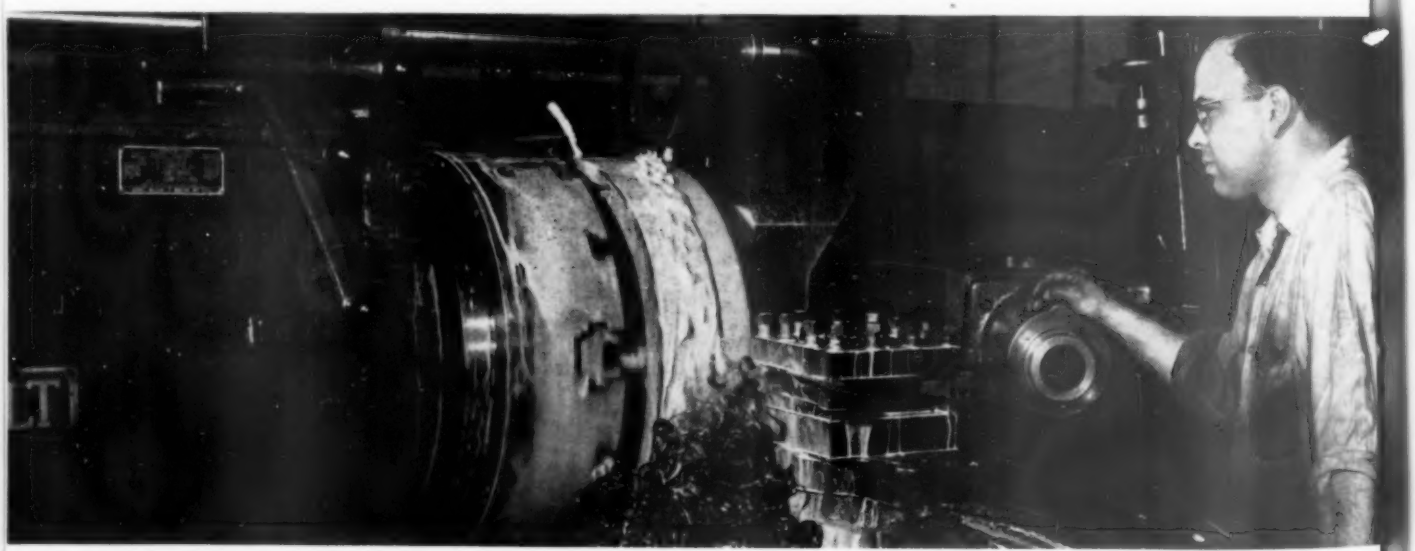
For complete information about S.E.C.O., write SUN OIL COMPANY, Philadelphia 3, Pa. Address Department TE-10.

MACHINE: 2" automatic tapping machine • Parts: pipe fittings Metal: malleable iron • Operation: threading and chamfering 1½" 45° elbow • Cutting Speed: 75 sfm • Tools: high speed • Production: 306 pieces per hour • Cycle Time: 11¾ seconds • Cutting Oil: 1 part S.E.C.O. to 10 parts water



COURTESY BROWN & SHARPE MFG. CO.

MACHINE: Brown & Sharpe No. 2 Universal Grinding Machine Part: screw machine spindle sprocket • Metal: AISI-C1107 • Operation: grinding 90° included angle • Method: plunge-cut ground periphery of wheel • Grinding Oil: 1 part S.E.C.O. to 40 parts water



MACHINE: Gisholt turret lathe, model 4L • Part: 20" press mold shell, 22⅝" O.D., 6" depth, 20½" I.D. • Operation: turning and boring rough forgings • Materials: 40 to 50 carbon steel • Tools: Firthite carbide • Feed: .012 at 31 rpm • Cut: ½" to ¾" on O.D. and boring • Cutting Oil: 1 part S.E.C.O. to 10 parts water

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THE TOOL ENGINEER

Publication of The American Society of Tool Engineers

10700 Puritan Ave.
Detroit 21, Mich.

The Tool Engineer

Twentieth Anniversary—A Significant Milestone

Appropriately, this issue is dedicated to the 20th anniversary of ASTE. This anniversary is significant in many respects. All members may be justifiably proud that their Society, in addition to being one of the youngest professional groups, is without doubt the most progressive and fastest growing national engineering society in the country.

Starting from a meagre beginning in Detroit in January, 1932 and having only the vision of its founders for guidance and inspiration, it has grown to embrace 100 chapters supported by over 23,000 members. How this was accomplished, how well the Society was founded on a thoroughly workable democratic basis, and how the foresight and fortitude of the founders laid the solid cornerstone on which the Society has been able to grow and prosper is recounted by Stewart Hall in O. B. Jones' article beginning on Page 71. Recognized as one of the most able members to tell this colorful story, Mr. Jones is one of the founding fathers and was Society historian for many years.

Not content to rest on this phenomenal growth nor to bask in the light of reflected glory, the leaders of the Society are well aware of what must be accomplished and what can be achieved so that all tool engineers—our production brains—may take their rightful place in industry as well as in society. President Bellamy's article, starting on Page 81, is an inspirational message pointing the way to the engineer and reminding him of his obligations to society in this increasingly complex civilization.

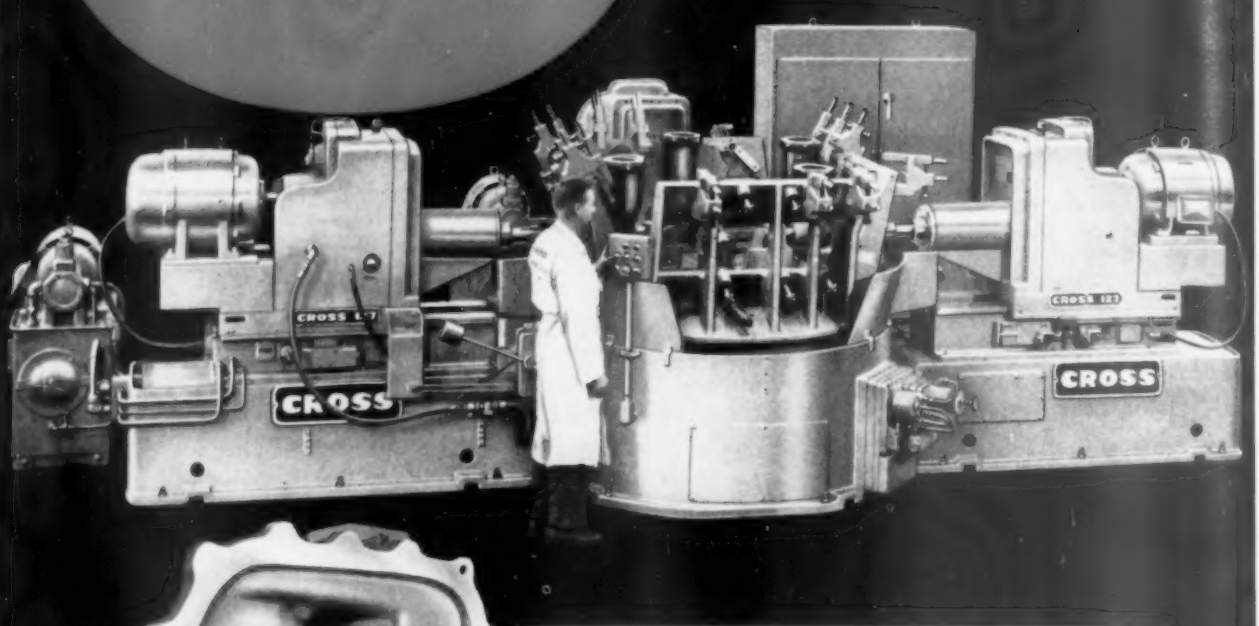
Growth of *The Tool Engineer*, being inseparably woven into that of the Society, is pictorially represented on the cover of this issue. Reproduced in miniature below, this cover portrays replicas of the first issue and of an intermediate issue as well as a would-be replica of the current issue as if it were a regular publication. Although differing in appearance, each symbolizes the continuity and growth of the Society. May the next twenty years record achievements beyond fondest hopes similar to those of the past two decades.

John W. Greve

EDITOR

Drills and Reams Tank Suspension Support Housings

Another Special by Cross



- ★ Drills and reams two holes of 3.995/4.000 diameter in 11 pieces per hour at 100% efficiency.
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- ★ JIC standard hydraulic and electrical construction with stranded wire.
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Applications and Advantages of Cast-Alloy Cutting Tools

By Chester M. Adams
VICE PRESIDENT AND CHIEF METALLURGIST
CROBALT, INC.

WITH THE GREAT VARIETY of machines and machining operations in use today, there is no one cutting-tool material that is best for all jobs. To meet the full range of operating conditions and production requirements, tool engineers and production men have found that three types of tool materials are needed: (1) high-speed steel; (2) cemented carbide; (3) cast alloy; each of these materials has applications where it equals or excels the others.

High-Speed Steel

High-speed steel is the most versatile of all tool materials, and serves to particular advantage in shops and toolrooms where a variety of parts are made in small quantities; where a number of different cutting operations are used; and, in general, where speed of production is not of prime importance. It works well where fine cuts are required, where heavy shock is encountered, and where the tool must be ground to a keen edge or a sharp point. It may be used on any machine where cutting tools are used, no matter how old or worn, for it is not damaged by vibration; and it does not require great power. Also, the grinding of high-speed-steel tools is relatively fast, simple, and well understood.

For many applications, a major disadvantage of high-speed-steel tools is their inability to withstand much heat, for when they approach the critical temperature (approximately 1200 deg F) they soften and are quickly ruined. For this reason, high-speed steel cannot be used for heavy cuts, and cannot take advantage of the speed and power provided in modern machine tools.

Cemented Carbide

Cemented carbide is primarily a high-production tool material, and is used to best advantage at high speeds with light to medium feeds and medium depths of cut. It is harder than either high-speed steel or cast alloy, and thus is able to machine harder materials; it also has greater abrasion resistance.

There is no doubt that if a carbide tool is correctly ground and properly engineered to the right type of application, it will outproduce any other tooling. However, carbide tools will not give full value unless the machine has the power and rigidity

Fig. 1. Here a $\frac{5}{8}$-in. square Crobalt alloy tool bit is used on an engine lathe. The depth of cut varies from $\frac{3}{8}$ in. to $\frac{1}{2}$ in. since the forging is not concentric.

to use these tools to their full productive capacity. Where there is vibration of the work or tooling, or where the tools are subjected to large impacts due to interrupted cuts, the carbide tip often breaks, causing costly down time.

Furthermore, the grinding of carbide tools is a slow and exacting operation, best done by a carbide grinding specialist using costly and hard-to-get diamond wheels. Many of the larger companies have the men and equipment needed for proper grinding, but all plants are not so fortunate. A carbide tool can be ruined by improper grinding, and many

Fig. 2. This is the same part shown in Fig. 1; 365 pounds of metal have been removed. The total machining time is seven and a half hours.

carbide tool failures are caused in this way rather than by improper use.

Cast Alloys

Since many tool and production men are not familiar with cast alloys, the following brief facts will give a better understanding of the proper applications of cast-alloy tools.

Cast-alloy tool materials are composed of approximately 40 to 55 percent cobalt, 25 to 35 percent chromium, 10 to 25 percent tungsten and 1 to 2½ percent carbon, plus small amounts of iron, nickel, molybdenum, vanadium and other materials. The particular analysis is melted in an electric furnace, and the tool bits are cast to shape with a small amount of stock allowance for grinding.

Depending on the particular alloy, the tools are at their maximum hardness of Rockwell C58 to C64 when removed from the molds. This hardness is a permanent property of the cast alloy up to temperatures of 1500 deg F, for these materials have no critical point. Thus cast-alloy tools have the property of red hardness. They cut as well at 1500 deg F as they do at room temperature, and in many cases can be used without coolant.

Cast-alloy tools have good resistance to abrasion, due in part to their Rockwell hardness and in part to their metallurgical make-up. These materials consist primarily of crystals of chromium and tungsten and their carbides held in a cobalt matrix. The operating characteristics of the tools depend largely on the size, number and distribution of these crystals so that a high degree of control in manufacture is necessary to provide desired and consistent cutting characteristics.

True cast-alloy tool applications are those which call for medium speeds with medium to heavy feeds or deep cuts, or both. These tools perform efficiently on practically all cutting operations, and can be used on stock with a Brinell hardness as high as 350 to 400. They withstand medium shock, and can thus be used on interrupted cuts; and they work well on lighter and older machines that are not extremely rigid or highly-powered.

Cast-alloy tools generally require a radius to operate efficiently (the size of the radius depending on the operation), and are not recommended where a pointed cutting edge is required. They are not recommended for use on a planer or shaper where the tool drags over the stock on the return stroke, but can be used to good advantage on such machines where the tool is lifted on the return stroke, preferably as tipped tools.

Grinding of cast-alloy tools is fast and simple, and requires no special equipment. Details are given below.

Various Grades Available

Every cast-alloy tool manufacturer makes tools of different analyses to completely cover the field of true cast-alloy applications. The softer but tougher

Fig. 3. On this operation, the substitution of cast alloy tooling increased production from 47 to 83 pieces per shift in machining this stainless steel aircraft fitting.

grades that have a lower percentage of the harder elements are used on cutting applications on the border line between high-speed-steel and cast-alloy applications. The medium-hard, medium-tough grades cover a range of applications where no other material can approach their efficiency; and the

rdest and less-tough tools cover the upper part of e range of cast-alloy applications plus the borderne cases where either cast alloy or cemented carde may be used effectively.

There may be some question as to why there is more than one grade of cast alloy. The answer is found by looking at the other types of tool material. There are many grades of high-speed steel to completely cover the range of high-speed-steel applications; and there are many grades of cemented carbides to cover the range of cemented carbide applications. By the same token, there are many grades of cast alloy to fully cover the field of cast-

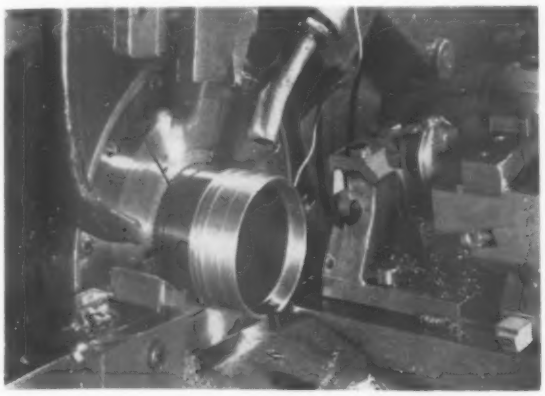


Fig. 4. This picture shows a cast alloy tool taking a cut of 3/16 in. at 0.020-in. to 0.35-in. feed and 75 sfm speed. The ID tool takes a 1/8-in. cut and the facing tool 0.035 in. at the same feed and speed as the turning tool.

alloy applications. It has been found, however, that three grades of cast alloy meet practically all requirements in the latter field.

How to Apply Cast-Alloy Tools

Conditions vary so greatly from one operation to another that it would be impractical to state specifically what to do in every possible case. The following recommendations, however, will point the way. These are based on the experience of many users of cast-alloy tools on a wide range of applications.

1. If high-speed steel is being used successfully at a given feed, speed and depth of cut, and greater production is desired, change to the appropriate grade of cast-alloy tool, and increase the surface speed 25 to 50 percent. Then double the feed or depth of cut, or both; and adjust these factors until the best combination of speed, feed and depth of cut is obtained for the particular operation.

2. If high-speed steel is failing because of overheating, start with cast-alloy tools at the same speed, feed and depth of cut; increase these factors until best results are obtained.

3. If cemented carbide tools are working efficiently and the application seems to be a border-line

Fig. 5. Working at 180 sfm, the cutoff tool takes a 0.007-in. chip, and the boring tool has 0.010-in. feed and 0.030-in. depth of cut. These tools respectively produce 700 and 1,000 p'eces per grind.

case, the same production may be obtained at lower cost with cast-alloy tools by reducing the surface speed by 30 to 40 percent and doubling the feed.

4. If carbide tools are chipping, replace them with cast-alloy tools. Start with the feed, speed and depth of cut recommended by the tool manufacturer, and work toward the optimum operating conditions. Cast alloys have greater shock resistance than cemented carbides, and often work at the same production rate with much less down time for tool replacement.

5. If neither cemented carbide nor high-speed steel gives the desired performance, use cast-alloy tools of the grade recommended by the manufacturer. Start with the recommended speed, feed and depth of cut, and vary these factors as indicated by results obtained to reach the best combination for the job.

Selecting the Grade of Cast Alloy

Cast-alloy tool manufacturers are qualified to recommend the grade best suited to specific applications. The following will serve as a general guide when substituting cast-alloy tools:

Changing from high-speed steel: start with one of the harder (higher-alloyed) cast alloys, and change to a somewhat softer grade if results so indicate.

Changing from cemented carbide: start with one of the harder (higher-alloyed) cast alloys, and change to a somewhat softer grade if results so indicate.

When using cast-alloy tools for the first time: start with a medium grade; use it at the speed, feed and depth of cut recommended by the manufacturer; work either way as the results indicate.

(Continued on page 47)

Finish Grinding

Troubles and Remedies

By A. W. Todd
CHIEF ENGINEER VAN NORMAN COMPANY

Part I

CYLINDRICAL GRINDING is a precision means of finishing a surface to a degree of accuracy that generally can be accomplished in no other way. Not unlike other machining processes, however, many errors can develop so as to directly affect quality and cost. As a rule, these errors are the result of negligence in applying correct techniques, or in maintenance. Due to the nature of grinding, the machine equipment is subjected to many more hazards than other forms of metal-cutting tools. On this account every precaution should be taken to keep grinding machines in proper operating condition: otherwise they will cease to offer the precision expected.

Set-up and Operating Practice

Good grinding starts with a full knowledge of machine operation and set-up. The most important considerations involve the wheel and its drive, basically the heart of grinding. Many common errors can be traced to faulty wheel operation, often the result of overlooking well-established practices. Or, to put it another way, exercise ample care in making sure that the wheel drive is operating properly and the grinding machine will produce at peak efficiency. The diagram in Fig. 1, which is a representative spindle drive, shows the main points to observe.

Wheel Dressing and Balancing. A new wheel should be carefully balanced with its wheel center before being applied. The wheel should then be dressed and removed for re-balance. Wheels usually are balanced by the manufacturer, but slight variations exist, especially when the wheel is mounted on its center. Even after the first balance and dressing, there still may be a slight out-of-balance condition which the second balance will correct, and thus prepare a wheel to a near perfect condition. Out-of-balance is the cause of chatter and out-of-round grinding, and, if exaggerated, can cause damage to the wheel spindle.

Clean blotters should be mounted on each side of a new wheel. The flange of the mount should be tightened uniformly, in various stages of tightness and alternating back and forth, until the final pull has been accomplished. A torque wrench is the recommended means of obtaining the correct pull. Then, after a wheel has been in use for a full shift or slightly longer, the screws should be rechecked for tightness, which may be effected by the compression of the blotters.

Belts and Power. Belts can be the source of grinding troubles, such as slippage, a set being mismatched or improper alignment. Check the belts carefully because any deviation from a perfect set will be reflected in the finish of the work. Ample power is very important because a momentary drop in speed is reflected directly in the work. A good practice is to equip the machine with the next size larger motor if in doubt. For example, if a 7½-hp motor is normally required, install a 10-hp motor as a margin of safety. As a good average, it requires 10 hp to remove one cubic inch of steel per minute.

Coolant. When a grinding machine is started after a long idle period, the spindle should be run for a few minutes to warm it up, because there are changes that result from expansion as operating temperature is reached. Keep the coolant turned on during the warm-up period so that the wheel can become uniformly saturated. When shutting down a machine for any period, turn off the coolant and

Presented at the Twentieth Annual Meeting of American Society of Tool Engineers, March, 1952.

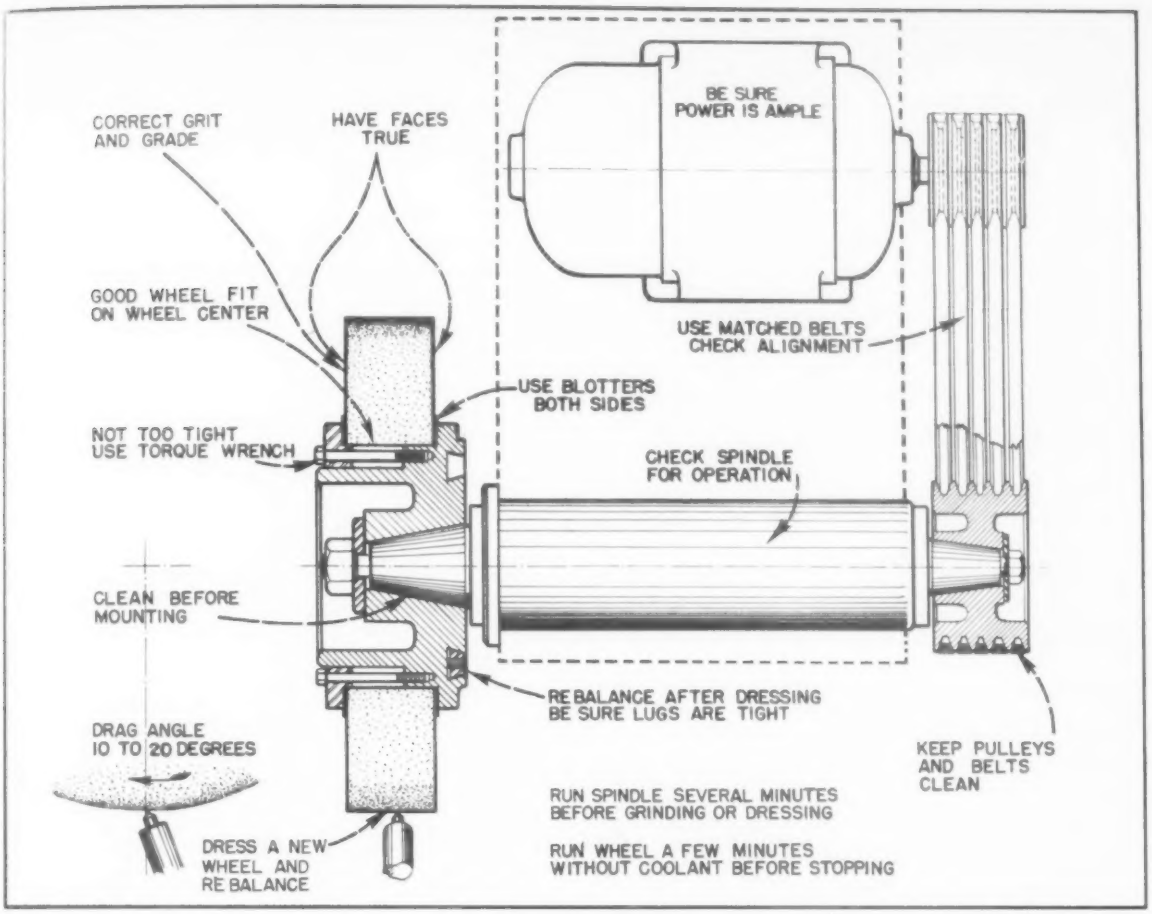

CORRECT GRIT AND GRADE
HAVE FACES TRUE
BE SURE POWER IS AMPLE
GOOD WHEEL FIT ON WHEEL CENTER
USE MATCHED BELTS CHECK ALIGNMENT
USE BLOTTERS BOTH SIDES
NOT TOO TIGHT USE TORQUE WRENCH
CHECK SPINDLE FOR OPERATION
CLEAN BEFORE MOUNTING
REBALANCE AFTER DRESSING BE SURE LUGS ARE TIGHT
DRAG ANGLE 10 TO 20 DEGREES
KEEP PULLEYS AND BELTS CLEAN
RUN SPINDLE SEVERAL MINUTES BEFORE GRINDING OR DRESSING
DRESS A NEW WHEEL AND RE BALANCE
RUN WHEEL A FEW MINUTES WITHOUT COOLANT BEFORE STOPPING

Fig. 1. Shown here is a representative grinding spindle drive. Main check points are illustrated.

run the wheel for a few minutes to throw off excessive coolant. If a wheel is stopped while saturated with coolant, the coolant seeps to the lower portion of the wheel and remains there. Then, when the wheel is again started, a serious out-of-balance condition exists which could cause an excessive strain on the wheel spindle bearings.

Wheel Characteristics

Cylindrical grinding machines must have an accurate relationship between the work and the wheel. Due to the high velocity at which wheels travel, the machine spindle must be built with precision, it must be rugged, and by all means, it must be precisely balanced. Aside from the machine itself, assuming the work speed and feed to be correct, the characteristics of the wheel have an important influence on grinding machine performance. Such factors as the type of abrasive, the grain size, the type of bond and the structure or porosity are directly related to type of finish that will be obtained.

Wheel hardness governs the rate of break down. Usually, harder wheels are used where accurate forms are essential and where the forms must be maintained. Softer wheels are applied where there is a tendency for burning or glazing to take place. Wheels often can be made to act harder or softer by variation of the grinding compound. Wheel structure is varied to provide a more dense or a more open spacing of the grains. The porosity of the grain directly affects chip clearance and chip removal, and has an influence on how well the grinding fluid reaches the point of contact.

A properly dressed grinding wheel is composed of thousands of abrasive cutting edges. Theoretically each edge removes a small chip as it passes the face of the work being ground. These edges become dull or fracture in such a way as to present new cutting edges, or they are torn away entirely so that subsequent underlying cutting edges take over. Softer grits, used for grinding hard material, are more apt to fracture, while the harder grits, used for grinding softer materials, usually become dull. Dulled edges increase grinding pressure, create excessive friction and produce unwanted heat. Since all the cutting edges of a wheel do not remove equal amounts of metal, it is the average sharpness that determines the wheel's efficiency. A knowledge of these conditions is important because they affect the forces that develop between the wheel and the work, the rate at which the wheel wears and, consequently they affect the power required for grind-

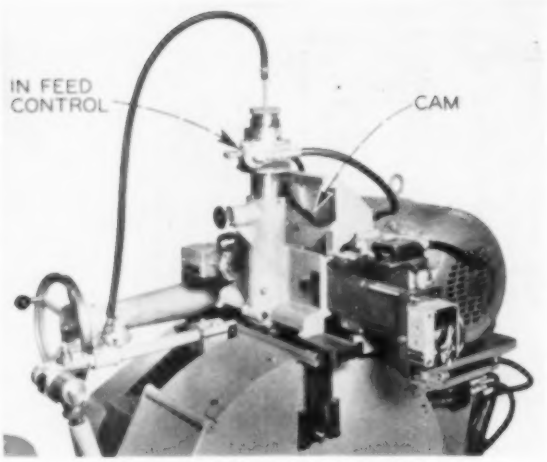


Fig. 2. This is an automatic dresser of the hood type.

ing. With good average sharpness, power and wheel wear are more constant, with the result that wheel life is improved.

Wheel Truing Considerations

When truing a wheel with a diamond, it is well to make sure the diamond is supported rigidly so as not to set up a chatter or vibration. Not more than 0.001 in. should be removed per pass. The drag angle of the diamond should be about 10 to 20 deg, and the diamond should be rotated at regular intervals to distribute wear evenly around the point. When possible, dressing should be started at the center of the wheel for the first pass to avoid too deep a dress. Use plenty of coolant and never cut off the coolant while the diamond is in contact because rapid temperature changes cause diamond fracture. Use a correct feed rate, preferably automatic. Too slow a truing feed causes glaze and too high a feed will result in diamond marks. Usually a feed of from 20 to 30 ipm will be found suitable. Dress wheels at regular intervals and never allow the wheel to become too warm. There is more wheel economy in frequent light dressings than in fewer deep dressings.

An automatic-type dresser of the hood-type is shown in Fig. 2. The slide carrying the diamond quill is hydraulically controlled so as to provide the correct feed rate. The in-feed control for the diamond also is hydraulically operated, with feed increments of 0.00025 in. to a maximum of 0.001 in., the in-feed being selected by an adjustable shroud. The cycle to start truing is manual by push button, or it can be controlled automatically from a counting device after a predetermined number of pieces have been ground. The cycle includes feed in one direction automatic reversal at the end of the stroke, feed in the opposite direction, automatic stop and, finally, in-feed of the diamond quill as preselected in readiness for the next pass. Truing devices of this kind eliminate some of the hazards of wheel dressing and contribute to better grinding.

Regulated Maintenance

Maintenance of grinding machines, as has been mentioned, is of utmost importance and is an ever-present problem that cannot be taken too lightly. The type of service a grinding machine is called upon to perform will influence the amount of attention it will require, but, regardless of duty, if a machine is used continuously, periodic inspection is advisable.

It is well to remember that small abrasive particles and extremely fine chips are ever present around a grinding machine. These particles may be airborne from the work and wheel, or may be carried off in the coolant in the form of a fine film. This dust and grit has a tendency to work its way into the slides and other moving parts of the machine, so that the evil of accelerated wear exists. Good housekeeping, thus, becomes a prime issue.

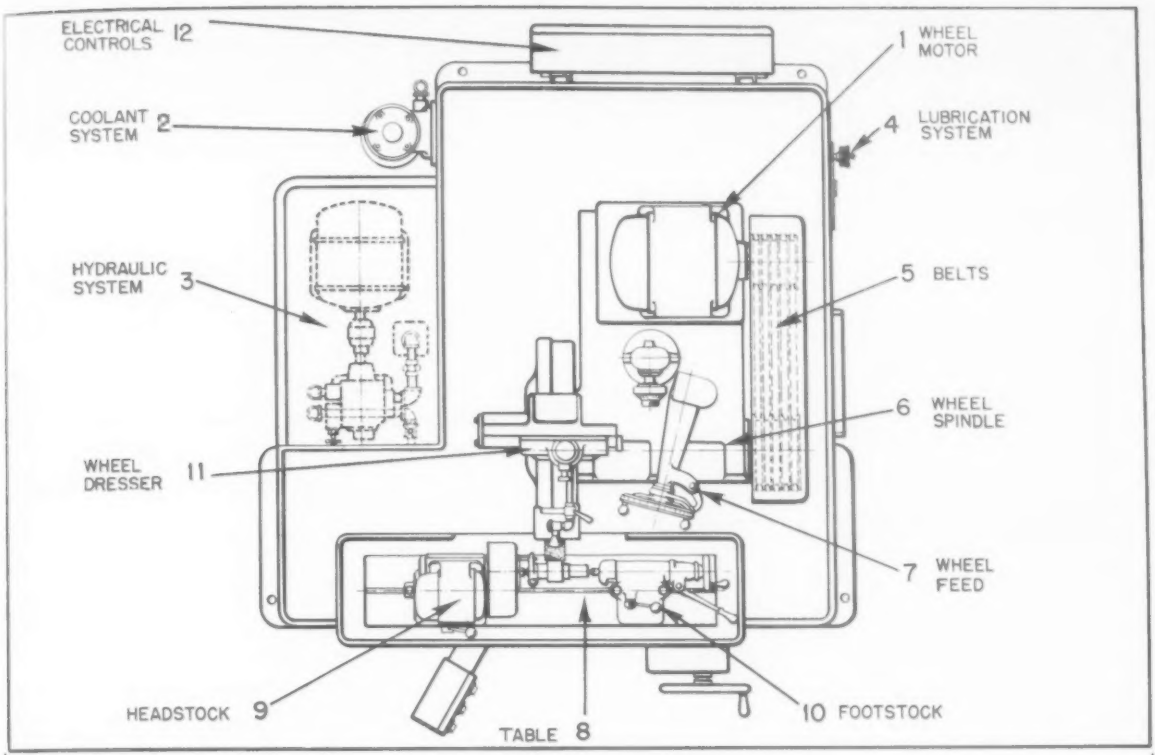
In Fig. 3 is shown a diagram of a grinding machine with references to the basic operation units that require periodic check-ups. Reference to the numerals in connection with the chart, shows the frequency with which check-ups should be made.

Operating Feeds and Speeds

For average cylindrical grinding, the traverse feed rate of the work should advance in relation to the width of the wheel. At *A* in Fig. 4 is shown a feed that is too slow, in which the work traverses only about $\frac{1}{4}$ of the width of the wheel or less. With a fine feed of this kind, the work is more apt to pick up a feed pattern, whereas most of the wheel wear will take place on the edges. Where possible, the feed rate should average from $\frac{1}{3}$ to $\frac{3}{4}$ the width of the wheel per revolution, with $\frac{1}{2}$ as a good average. At these feed rates grinding will be faster, the finish will be more uniform and wheel wear will be distributed over a greater area of the wheel face. Narrow wheels as at *C* should be avoided as far as possible in preference to a wider wheel as shown at *D*, which is capable of removing more material and giving a more uniform surface.

Work speeds for average steel parts range from 60 to 110 ft. per min. where the part is symmetrical. With parts that may be unsymmetrical, slower speeds of 40 to 70 ft per min. should be used. On parts of extreme irregularity where an out-of-balance condition exists, speeds as low as 20 to 40 ft per min. may be required to avoid out-of-round surfaces. Speeds for cast iron and aluminum are usually higher.

Vitrified grinding wheels are run at speeds around 6500 ft per min., while resinoid bonds are operated at from 9000 to 10,000 ft per min. On steel parts where exceptionally high lustre finishes



Daily—
- 2 Check coolant level in reservoir. Fill as needed
- 3 Check oil level. Add recommended oil as required
- 4 Be sure there is sufficient oil in lubricating system
- 8 Keep table and table ways clean. Wipe and oil often
- 11 Keep dresser clean, whether table or hood-mounted type

Weekly—
- 9 Check headstock drive, belts, add lubricant as needed
- 10 Chck footstock operation, inspect for play and wear
- 2 Clean out coolant reservoir, fill with fresh coolant
- 3 Check hydraulic oil. Clean out, refill if necessary
- 5 Check belt alignment, adjust tension, replace if worn

Monthly—
- 6 Check spindle bearings for play, operating temperature
- 8 Remove table, clean ways, replace wipers if necessary
- 11 Check dresser operation, clean moving parts thoroughly

Every Six Months—
- 1 Check bearings, brushes, lubrication of wheel motor
- 2 Check bearings, brushes, lubrication of coolant motor
- 3 Check bearings, brushes, lubrication of hydraulic motor
- 7 Remove, clean hand feed control, adjust to suit
- 9 Check bearings, brushes, lubrication of headstock motor
- 12 Inspect wiring, and all controls in electrical panel

Yearly—
- Thoroughly check foundation and alignment of machine, rescrape any ways that are worn, completely overhaul machine as needed, replace all worn parts and repaint.

Fig. 3. This chart shows the maintenance schedule to be observed for grinding machines.

are required, vitrified wheels are operated slower than normal, usually around 5000 ft per min. In view of the wide variations in wheels and the speeds at which they operate best, it is advisable to consult the manufacturer for specific recommendations.

Application of Coolant. The most important function of a coolant is to flush away the material being removed, to keep the wheel clean and to keep the temperature of the work uniform rather than to keep it low. Usually, it is best to hold the temperature of the work as near to room temperature as possible. In some cases refrigeration is essential, preferably with automatic thermal control. Magnetic coolant separators are used to remove small metal particles and other foreign matter so that they will not mar or scratch the surface of the work.

In applying coolant to grinding operations, the volume supplied is far more important than the pressure. The volume depends on the type of job performed but on an average, a flow of five gallons per minute for each inch of wheel face will be found satisfactory. Any lack of coolant will result in excessive heat and cause out-of-roundness of the work. Another rule sometimes used is to supply two gallons for each horsepower of the wheel drive motor. The reservoir of the machine should hold about four to five times the maximum rated flow of the pump in gallons per minute. Even more than this capacity is advisable. For specific or specialized coolant needs, it is best to consult the supplier for recommendations.

(Continued next month)

Nomogram for Determining Taper Per Foot and Angle of Taper

By Leonard M. Majeske
REGISTERED PROFESSIONAL ENGINEER

THIS NOMOGRAM may be used to find taper per foot and the included angle α, when horizontal and vertical dimensions are known (see Fig. 1). Scale d for the vertical dimension is given in fractional and decimal dimensions.

The use of the nomogram is demonstrated by the following example where:

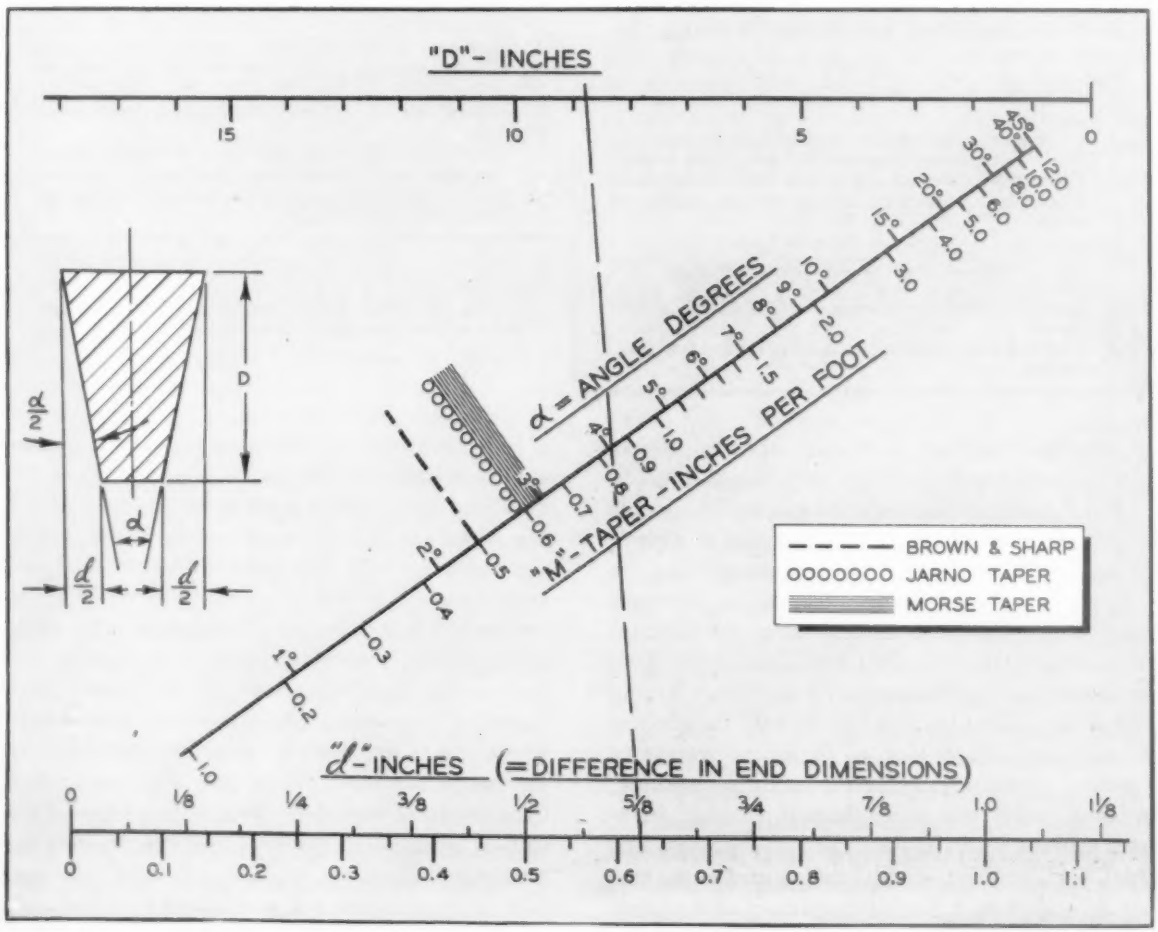
$d = 5/8 = 0.625$ inches (difference of vertical dimensions)

$D = 8\frac{3}{4}$ inches

Draw line connecting d and D.

Then, $M = 0.86$ inches per foot and, $\alpha = 4.1$ degrees.

The procedure may be reversed to find the horizontal and vertical dimensions when the taper is known. The range of this nomogram may be extended by multiplying both the d and D scales by any factor.



Wet Grinding Saves Diamonds

By David Kauffman
TOOL ANALYST

NATIONAL PRODUCTION AUTHORITY order M103, covering diamond grinding wheels, established inventory and user restrictions which were effective April 1, 1952. Inventories were limited to the smallest quantity "reasonably required to meet his deliveries or supply his services on the basis of his currently scheduled rate of operation during the next succeeding 60 days." Users were prohibited from using diamond grinding wheels "for offhand rough grinding of cemented carbides or for the grinding of ferrous metals." The order also prohibited the use of resinoid diamond grinding wheels "for offhand finish grinding of cemented carbides." Resinoid diamond wheels finer than 325 mesh, however, are specifically exempted from this latter prohibition. In addition to these regulations, the order also provides that, "On and after April 1, 1952, in the use of diamond grinding wheels for the finish grinding of cemented carbides, either wet grinding, wick grinding or mist grinding, employing coolant, must be used, except in the case of profile grinding. In the event it is necessary for a user to install apparatus . . . for applying such coolant, he may continue dry grinding until the installation of such apparatus, but in no event after June 1, 1952."

Since diamond wheel users are directed by law to utilize wet grinding, additional reasons would seem to be superfluous. Nevertheless the economy of wet grinding is not without interest in these days of soaring costs. A large manufacturer of these wheels has published the figures in Table I as the result of a study on the effect of coolant on grinding cost.

Independent surveys in industry have not only confirmed these claims in principle, but have demonstrated them to be relatively conservative. Entirely apart from the savings involved, the increased life of the wheel is of paramount importance in view of the critical shortage of the bort from which the wheels are made. Maximum use must be obtained from every wheel and as the study indicates, wet grinding will insure a 100-percent increase through decreased wear.

Unfortunately, the majority of tool-room surface

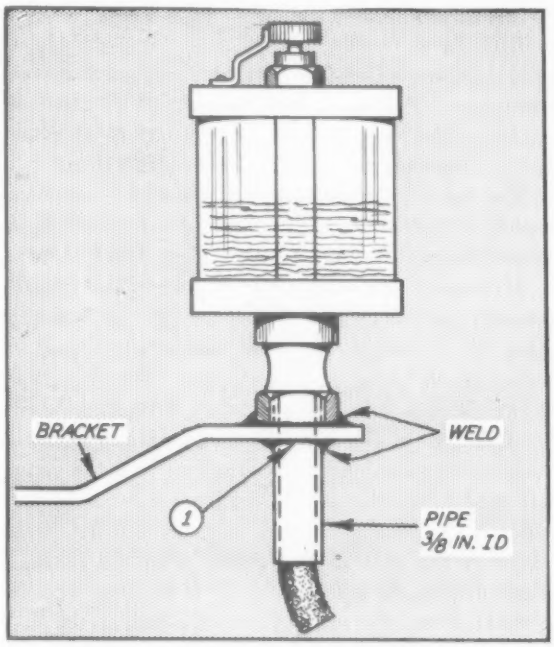


Fig. 1. A common drip cup is used to apply coolant to diamond wheel. Assembly shows bracket and wick retaining pipe welded together.

grinders and cutter grinders were not designed for wet grinding. This means that it is impractical in most instances to apply a stream of coolant to the wheel and the work, although this is acknowledged to be the most efficient method. Many of the same objections apply to mist grinding, so that for existing grinders the wick method is the most practical and is suitable for nearly 90 per cent of all carbide

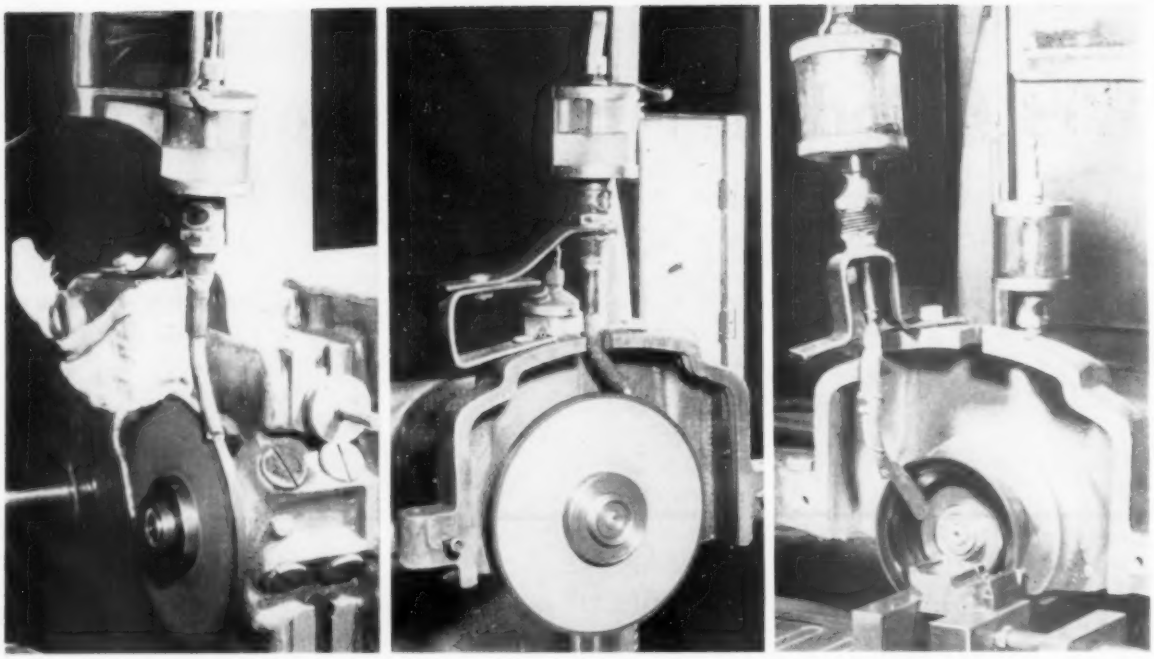


Fig. 2 (left). Application of drip cup assembly on cylindrical grinder not equipped for wet grinding. Note 'arc' of felt wick indicating necessary pressure of wick against diamond wheel. Fig. 3 (center). Typical coolant application for grinding carbide on surface grinder. Note contact of felt wick with diamond wheel. Fig. 4 (right). Coolant applied to special shape wheels or for special set-ups can be facilitated by wrapping wire around felt wick and bending wick to required shape.

tool grinding. Grinders can be equipped inexpensively and simply to use coolant, irrespective of make or design, and will handle cutters of every kind, dies, wear parts and other carbide forms.

The items required to equip a machine for wick grinding consist of a medium size oil drip cup, a piece of round felt and suitable pipes and brackets.

A common drip cup assembly, ready for attachment to the machine, is shown in Fig. 1. Note the strap iron bracket and pipe which is welded or bolted to the base of the oil cup. The felt wick shown in Fig. 2 is approximately three-eighths or one-half inch in diameter and may be obtained from most screw machine supply houses. It is the same felt used to fill the oil hole to keep dirt out of the collet on automatic Gridley screw machines. The length of the wick is determined after the bracket is attached to the machine. It must be long enough to reach from the wheel to the cup-end of the $\frac{3}{8}$-inch pipe (point 1 in Fig. 1). The wick must be reduced in diameter to fit into the pipe, since too tight a fit will obstruct the coolant flow. Too loose a fit will cause the felt to fall out of the pipe or to bear against the wheel with insufficient pressure. It is recommended that a series of small flats be ground on one end of the felt to obtain a snug fit. and permit the free flow of coolant.

The bracket can be made of 1-in. x $\frac{1}{8}$-in. strap iron and it may be attached to the machine by any of several methods. One way is to drill several holes into the end of the bracket. By drilling and tapping corresponding holes into the wheel guard, it can be attached and bent to support the drip cup in position as shown in Fig. 2. In some instances an additional bracket may be required to provide sufficient clearance between the end of the pipe and the wheel guard. This is illustrated in Fig. 3. Some installations may require that a U-shaped slot be cut in the upper portion of the wheel guard to permit the wick to be positioned on the OD of the wheel directly under the drip cup. This type of installation is shown in Figs. 3 and 4.

From the foregoing, it will be obvious that the $\frac{3}{8}$-in. pipe acts both as a retainer for the felt wick and as a conductor for the coolant. When the assembly is in position, the felt is pulled out of the pipe far enough to bear with some pressure against the wheel. The pressure is necessary in order to wet the diamond wheel and is achieved by pulling the wick out of the pipe far enough to form a small arc. With this arrangement the stiffness of the felt causes it to exert sufficient pressure against the wheel to give satisfactory performance. The wick will wear due to constant contact and after an hour or more it will be observed that the arc has disappeared. When this happens, the wick can be pulled out another $\frac{1}{16}$ inch and grinding continued. In this fashion one wick should last for two days or more. It is suggested that a supply of the felt wicks be kept on hand to facilitate rapid changing when different size wheels are used.

For cooling cup wheels and others, it may be necessary to bend the wick into a C-shape in order to apply the coolant to the desired location. Suffi-

TABLE 1
EFFECT OF COOLANT ON GRINDING COST

	Down Feed	Wheel Wear	Wheel Cost
Dry	.001	.024"	$.73
Wick	.001	.012"	.31
Stream	.001	.007"	.21

cient rigidity to do this can be imparted to the wick by coiling a piece of soft copper wire around it and then forming the bend. This is illustrated in Fig. 4.

The coolant should flow at the rate of about one drop every three or four seconds. This amount will be adequate to keep the work and the wheel cool, and should have a negligible nuisance value. A few wiping cloths around the base of the magnetic chuck or the ways will prevent damage to the machine. By removing the wick from the wheel, the operator can observe the grinding action without having the spray fly into his face. Simple aluminum or copper foil shields can be attached to the wheel guards, particularly in the case of cutter grinders, to keep the slight spray from flying into the air. An accumulation of sludge will be found around the workpiece, but this can be removed readily by means of absorbent tissue paper, or by blowing with an air hose.

The coolant to be used should not clog the wick, become gummy or load the face of the wheel to prevent free cutting. Coolant will effectively reduce the wear on a diamond wheel by keeping the wheel free from loading, prevent overheating and damaging the bond. A clean wheel will require less grinding pressure, cut freer and prevent diamonds from being pulled out of the bond. Some coolants have included kerosene, mineral seal oil, mixtures of these two and mixtures of kerosene or mineral seal oil with carbon tetrachloride. It should be noted that this latter material may be toxic and its use for this application is not recommended.

Plunge grinding and chip breaker grinding is extremely detrimental to the life of diamond wheels, due to the amount of heat generated. For these applications the flow of coolant should be increased to one drop per second to minimize wear to the wheel.

The bulk of form tool grinding should be accomplished wet; the final finishing operation can be done dry. Cutter grinding with cup wheels should also be done with a coolant. The wick method of application is readily applicable as shown in Fig. 2, using a special bracket. The operator can wipe the workpiece with tissue paper to observe the status of his grinding operation.

Cylindrical grinding is usually done on wet grinders, but may be done on such machines as the B & S #13, which are usually not equipped for coolant. Fig. 2 shows how the drip cup is attached to the wheel guard of such machine.

The chief obstacle to be overcome in wick grinding is usually the attitude of the operator. Many of them will resent the "dirty" condition of their machines and workpieces, since the sludge will tend to adhere due to the moisture. This attitude may be overcome by explaining the necessity for the conservation of diamond wheels and by supplying an adequate supply of paper towelling at each machine. When it is realized that the rate of usage of diamonds in the year 1951 exceeded the rate of import and reclamation by 500,000 carats, according to the NPA survey, the seriousness of the situation is apparent. The continually expanding use of cemented carbide tools makes it mandatory that present supplies of diamond grinding wheels must be conserved and that new methods of finishing carbides must be developed. The present world situation permits no other alternatives.

Acknowledgment

To Mr. G. F. Bush for his assistance in the preparation of this paper.

Cast-Alloy Cutting Tools

(Continued from page 39)

Because they are castings, all cast-alloy tools are slightly softer and more porous at the center than they are at the surface. For this reason, the cutting edge of the tool should be kept as near the outside surface as possible. In grinding, stock should be removed from the ends, not from the top or sides.

These tools are readily ground with any soft grade (F or J) vitrified wheel of about 46 to 60-grain size for roughing and 80 to 100-grain size for finishing. Wheel speed should be about 3000 to 4500 sfm, and stock removal 0.001 to 0.002 in. per pass. Wet grinding is recommended, using a good lubricating coolant in generous quantity at the point of contact. If dry grinding is used, be sure never to quench the tool.

For most consistent results, hone all cutting edges at a 45-deg angle before putting the tools to work. This removes any minute protruding particles which may otherwise break out and start a premature breakdown of the edge.

Form tools made of cast alloy can be machined to rough form with the correct grade of cemented tungsten carbide. Although this procedure is difficult, it is sometimes less expensive than complete grinding.

Always give cast alloy tools as much support as possible by keeping the overhang and clearance angles to a practical working minimum.

Precision Hole Locating Methods

By Frederick C. Victory

CHIEF ENGINEER
MOORE SPECIAL TOOL COMPANY, INC.

Part II

ACCURATE AND EFFICIENT tools and accessories contribute much to the overall accuracy produced by either a drill press or a milling machine. This applies to set-up tools such as parallels, rotary tables and sine plates, as well as pickup and measuring instruments including special indicators, edge finders, microscopes and hole gages. Absence of these on the spot when needed usually results in some makeshift arrangement, with the strong probability that errors will be introduced.

Precision hole location with the jig borer and jig grinder is a responsibility shared by the manufacturer and the operator. So far, only that portion has been considered which is built into the machines. It is axiomatic that a poor workman blames his tools, and a good one succeeds in spite of them. Unfortunately, the corollary is not always true; a good machine cannot produce good work under poor operating conditions. Therefore, the operator's responsibility is to get the most out of his machine by consistently employing sound, proven methods.

Certain practices and methods are common to both machines and these will be covered before proceeding to those which are peculiar to each.

Control of Thermal Expansion. While certain forms of thermal expansion cannot be eliminated by locating the machine in a temperature-controlled room, it is still a worthwhile precaution against rapid temperature fluctuation and loss of accuracy. Service calls have actually traced reported inaccuracies in machines to their proximity to steam pipes, radiators and open windows.

A constant temperature, preferably 68 deg F, provides the best working conditions. Even then, work from other portions of the plant should be allowed to equalize for some time before being machined. This is particularly true of nonferrous materials, some of which have expansion coefficients from one-half to twice that of the measuring elements in the machine.

Proper Clamping. Frequently, when holes appear to have been bored or ground out of parallel, the cause lies in faulty clamping of the work. This may result from the piece not being flat or from clamps not being directly over the supports. In this case the holes actually are parallel as produced by the machine but do not remain so when the work is unclamped. See Fig. 5. This error is often exaggerated by measuring to pins which extend from the surface of the piece. It is surprising how little pressure is required to bow a one-in. thick piece in this manner.

Errors of location and size can be avoided by first roughing all holes and allowing the resulting stresses and heat to dissipate before proceeding.

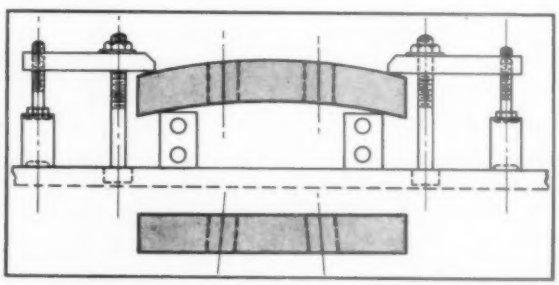


Fig. 5. Distortion of the workpiece in clamping as shown here results in non-parallel holes after the piece is removed from the machine.

Time can often be saved by removing the piece and working on another while waiting for this to occur.

Orienting the Work. Occasionally pickup or construction holes provide the only practical means for orienting the work when it must be repositioned for further machining, particularly in another plane. Generally such holes are not objectionable

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the work and, if necessary, can later be plugged. This technique also permits stretching the capacity of the machine beyond normal in certain instances.

While the rotary table undoubtedly has its place in the field of precision hole location, it can be a fertile source of errors even when used in conjunction with a jig borer or jig grinder. Based on polar rather than rectangular coordinates, its sources of errors begin with any inaccuracies of angular setting in the table itself. Picking up the center of the table from the machine spindle introduces a second possibility. Any error in centering the work on the table, or any movement of the spindle axis during the machining operation, results in an error of double magnitude in the work.

In general, higher precision can be attained when holes are located on a circle by converting the polar to rectangular coordinates by means of con-

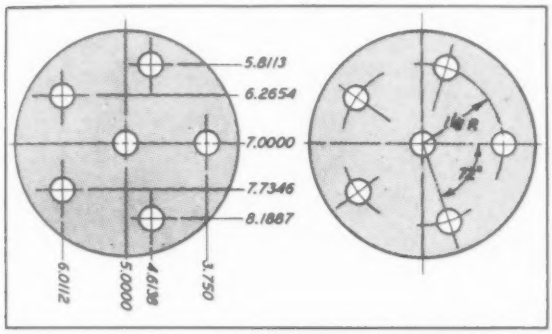

Fig. 6. Polar coordinates at the right have been converted to rectangular coordinates as shown at the left to promote greater accuracy.

venient reference tables available, and using the measuring system of the jig borer or jig grinder to locate the holes. See Fig. 6.

General Jig Boring Practice

Certain practices and techniques are not interchangeably applicable to both the jig borer and the jig grinder. Since the former precedes the latter historically, and in sequence of operations when used in partnership, it is desirable to discuss jig borer practices first.

Its use in toolmaking, small-lot production, or large-quantity production requiring higher accuracy than possible with jigs eliminates any chance of standardizing operating practices. At best, only a few generalities can be given.

In tool and model work, due to its non-repetitive nature, each job must be individually set up and oriented on the machine. Frequently this necessitates indicating one edge parallel with the table travel of the machine and subsequent pickup of two rectangular sides with an edge finder. Occasionally the pickup must be made from an existing hole, boss, or sometimes from layout lines. In the latter case a wiggler or locating microscope is helpful.

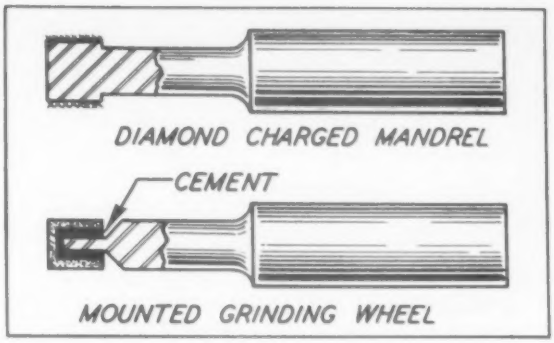

Fig. 7. Diamond charged mandrels provide greater rigidity and cutting efficiency than abrasive wheels for small hole grinding.

In order to minimize the possibility of operator setting error, it is recommended that the location of all holes be lightly spotted before any are spotted to normal depth. This practice serves to show up any obvious error before damage is done.

Piloted sweeping tools are very important tools for rapid removal of large amounts of stock. Unlike the conventional boring tool which exerts radial or side thrust, the sweeping tool imposes only axial pressure on the work.

When the highest accuracy of size and location is not required, as in work to be later hardened and jig ground, it is often possible to eliminate the boring operation entirely and finish the hole with a drill or end reamer.

To obtain the highest accuracy, it is advisable to recheck the location of the piece as insurance against its having shifted before final sizing by boring.

Under most conditions a plug gage provides the most accurate means for determining hole size. Due to the variety of non-standard hole sizes, and the desirability of knowing how much stock must be removed in bringing a hole to size, a variety of hole-measuring instruments are necessary for use with the jig borer.

General Jig Grinding Practice

Jig grinding practices require careful consideration due to general lack of familiarity of the machine. Then too, most workpieces represent a considerable investment by the time they are to be jig ground. These points, together with the generally higher accuracy requirement, indicate the need for an operator with experience on both a jig borer and an internal grinder.

All that has been said about setting up the work on the borer is applicable to the jig grinder. Because the grinder must work from existing holes, the pickup or orientation is more exacting.

Generally, the pickup, by indication, must include at least two of the existing holes, and preferably all of them. This permits averaging of the existing errors of locations, so that all holes will clean up

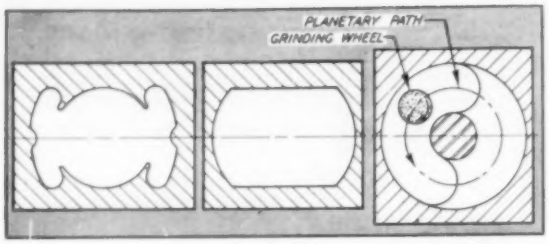

Fig. 8. Contours composed of radii, both male and female, and straight surfaces can be ground by planetary movement shown at right.

within their diametral limits. Sometimes angular shifting of the work is necessary, particularly when no two holes are on the same coordinate lines. Use of a rotary table greatly facilitates orientation of such pieces, especially when they are irregularly shaped.

The rate of stock removal in a jig grinder depends on many factors, the most important of which are the philosophy of design of the particular machine to be used, size of hole, resistance of the material to grinding, and the grinding technique employed.

Plunge grinding, when permitted by the above conditions, is the most rapid method of removing all but the last 0.002 to 0.003 in. of stock in a hole.

With the hole in position beneath the main spindle axis, and the wheel dressed and slightly concaved on the bottom, the grinding spindle is offset so as to cut within 0.002 in. of finish size. It is now plunged directly down on the work and cuts on the bottom corner, much like a boring tool. The entire amount of stock, less some taper, can thus be removed in one pass by using a slow feed. This is not practical in the case of very small holes or in carbide, but in most cases proves to be highly effective.

Outfeed grinding in the jig grinder is much like conventional internal grinding. The wheel is fed radially into the work in very small increments. Most of the cutting is done by the periphery of the wheel. This method produces the straightest hole, the best finish and control of size; thus, it is almost always used for finish cuts.

Small holes, from $\frac{3}{16}$ to $\frac{1}{64}$ in. or smaller, can be ground most efficiently using a diamond-charged mandrel instead of a wheel. In fact, toward the small end of the range it is the only means practical.

Mandrels are made most conveniently right on the job, tailored to suit the hole to be ground. They are turned from cold-rolled steel of a diameter to fit the collet in which they are to be held, and consist of a head about $\frac{7}{8}$ of the diameter of the hole to be ground, above which they are relieved by a few thousandths for sufficient length to permit grinding the full depth required. See Fig. 7. The cylindrical heads are charged with diamond dust by hammering. This knack is quickly acquired and requires 100-grit dust, a hardened steel block and a small hard hammer. The surface of the block is wiped with a film of oil and sprinkled lightly with the dust. The head of the mandrel is laid on the block and tapped firmly with a hammer as it is slowly rotated. The mandrel should be sloshed in acetone to remove the oil from the charged surface.

Those using this tool at first find it difficult to detect the first contact between mandrel and workpiece since there are no sparks. An amplifier is available to make the contact audible. Diamond-charged mandrels are run at about one quarter the speed recommended for a wheel of corresponding

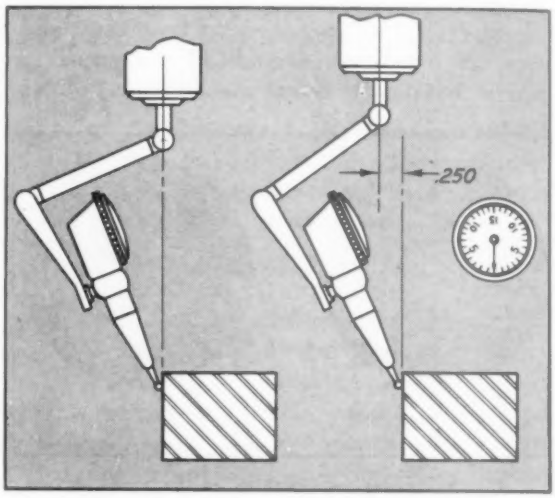

Fig. 9. To measure a 0.250-in. male radius, an edge is centered under this spindle axis as shown at the left. The edge is then moved 0.250 in. by the positioning system of the machine and the indicator set to read zero against the edge as shown at the right.

size, and have been found more efficient than the latter for holes smaller than $\frac{3}{16}$ in. In the range between $\frac{1}{4}$ and $\frac{3}{16}$ in., the choice is questionable.

Grinding holes of depth exceeding the diameter by more than six times is impractical. Where such a requirement is encountered, the hole should be relieved from the bottom.

Although recommendations as to grit and bond of wheels for different materials should come from the manufacturer of the machine, several general comments can be made: the wheel should be about three-fourths the diameter of the hole. Dress wheels all over to insure balance; this includes the lump of cement around the shank. Relieve wheel diameter by $\frac{1}{64}$ in. for about one-half the face width for cleaner grinding action. Use shanks as large in diameter and as short as possible; they should preferably be stainless steel ground to size.

Contours composed of radii, male or female, and straight surfaces can be ground accurately to dimensions in the jig grinder. To visualize this

(Continued on page 52)

Criteria for Efficiency

By John Starr

IN PREPARING PLANS for the manufacture of any new product or part, it is usually difficult to estimate production requirements with any degree of accuracy because there are no sound historical data for the accurate computation of costs. Consequently, it is not always possible to design and fabricate tooling of the type that will do most to assure efficiency until considerable production work has been done, at which time many hundreds of dollars may have been wasted, and remaining production requirements may be so slight that the cost of better tooling cannot be justified.

However, experience at an air craft manufacturer's plant has indicated that deficiencies due to inadequate planning can be minimized, if not eliminated, by making effective use of learning curves plotted on log-log graphs. A learning curve, in the sense that is implied here, is a yardstick for the measurement of efficiency, being based on an anticipated efficiency in terms of doubled quantities of production, and its use on logarithmic cycle paper permits the development of a straight line, as opposed to the contoured line of an arithmetical curve, so that the history of as many as 10,000 units can be recorded on a single 7 x 11-in. sheet of paper.

An 80 percent curve is taken as the criterion of normal efficiency at this plant because statistics for the entire aircraft industry indicate that the average percentage of learning efficiency is 20 percent. In other words, it has been discovered that operational efficiency is increased by a margin of 20 percent each time production requirements, for any given aircraft or part, are doubled.

For example, if a prototype aircraft or part is made in 100 hours, it is reasonable to expect that a duplicate part can be made in 80 hours, after which a fourth part could be made in 64 hours, an eighth part could be made in 51-⅕ hours, etc.

Plotting a curve naturally does not guarantee production efficiency, but it does establish a criterion whereby data obtained in constructing a prototype can be projected so as to show the amount of increased productivity that can reasonably be expected over a given period of time as the result of improved tooling, better equipment, better flow of work, education, simplification and other factors.

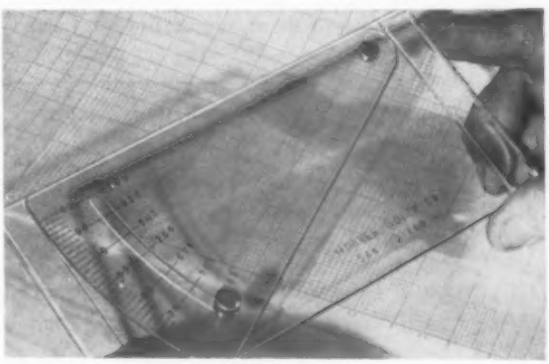

Fig. 1. A learning curve scale of the type shown here enables Consolidated Vultee personnel to predict and evaluate production efficiency with maximum speed and ease, regardless of mathematical training and ability.

To facilitate the preparation of learning curves by personnel lacking specialized mathematical training, this manufacturer makes use of a Horner Golem learning curve scale, as shown in Fig. 1. This clear plastic device is operationally similar to a slide rule, and its use permits the interpretation of actual man-hours on either a cumulative or unit curve basis, thus saving the time that might be required by specialized engineers to apply logarithm formulae to any given job. It is calibrated so that a straight line can be drawn for an efficiency curve from a flat line of 100 percent to a 70 percent curve on log-log paper; and it shows conversion factors

so that the latter can be multiplied by percentage-curve factors to convert cumulative time to unit time. Further, if unit time is divided by a conversion factor, cumulative average time can be computed at any given quantity on the graph.

Many observations can be made from learning curve charts, for example, the number of people required per month to produce a given quantity at any point in production and the square footage required to produce a given number of units in accordance with the quota of available labor at a scheduled rate of production.

Comparative curves, showing the man-hours required for work accomplished alongside the man-hours that should be required in conformity with past experience, are especially helpful in pointing out operational deficiencies that should be corrected by the use of better tooling at any given point in a production program. Therefore, learning curves are being used to evaluate the performance of sub-contractors as well as intra-plant production departments.

When a vendor's curve indicates no reduction in man-hours, a technical representative is usually made available to help the subcontractor attain an expected level of efficiency, thus minimizing the possibility that the vendor will suffer a large loss or be unable to make deliveries at reasonable prices in accordance with current aircraft production schedules.

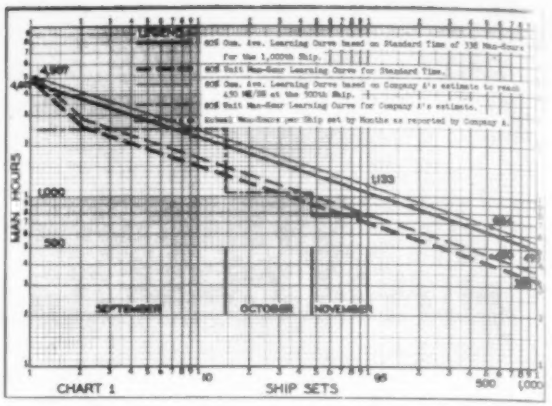

Fig. 2. A learning curve of the type used in evaluating the work of a Convair subcontractor.

Incidentally, the successful use of learning curves has not been dependent on the question of whether parts or assemblies could be fabricated with highly-mechanized or fully-automatic equipment.

Precision Hole Locating Methods

(Continued from page 50)

operation it is necessary to separate the individual elements of the contour and consider how each is ground to location and size.

Obviously female radii are ground exactly as a hole would be ground, the measuring method to be discussed later. Before considering the male radius, the feasibility of jig grinding the outside diameter of a vertical pin will be considered. A little thought will show that by reversing the procedure used in grinding a hole, i.e., feed the wheel inward instead of outward, a male cylinder can be ground. By limiting the rotation of the main spindle to an arc, a portion of this cylinder, or a male radius can be ground. See Fig. 8.

When straight surfaces are included in a contour, the job should be mounted on a rotary table. This permits alignment of the surface with the travel of the machine, and thus it can be traversed past the wheel.

The measurement of radii and straight surfaces presents a real problem unless the principle of indicator measuring is employed. In this application, the measuring system of the machine is used to establish size, and the indicator becomes a means of relating it to the desired portion of the contour.

With one edge of the workpiece or any block set square to the machine travel, this edge can be brought under the axis of the spindle as determined by an edge finder and indicator. Using the measuring system of the machine, this edge is now moved in the proper direction by the same dimension as establishes the radius. The indicator is now set to zero against the edge. See Fig. 9.

The point of origin of the radius to be measured is now repositioned in line with the main spindle axis, and the indicator against the radius will show, by the difference between its reading and zero, the amount of stock to be removed in coming to size. This method is equally applicable to male, female or straight surfaces.

Inspection of Finished Work. Inspection of both jig bored and jig ground work is best performed in place before removal from the machine. Some objection may be raised as to the soundness of checking work on the same machine which produced it. However, the accuracy and convenience of the measuring system, particularly under conditions where no machining stress, vibration or temperature changes are involved, outweigh any other consideration. As a matter of fact, so well do these machines serve this purpose that many are bought and used solely as inspection instruments.

Automatic Size Control in Finish Grinding

By W. E. Moody and R. A. Green
SALES ENGINEER ABRASIVE ENGINEER
BAY STATE ABRASIVE PRODUCTS COMPANY

Part II

IT IS PERTINENT to ask what kind of gage holds the above-indicated limits. Just as pertinent also is the question, what kind of machine has this absolute control. Each of the three basic gages in use in this country, Federal, Foster and Landis, operates on quite radically different principles.

The Federal gage, called the Electricator, is an electrical contact-type gage, requires a separate power supply, and operates on 12 volts. The amperage is correspondingly low. In case of electrical failures, the power used in this instrument

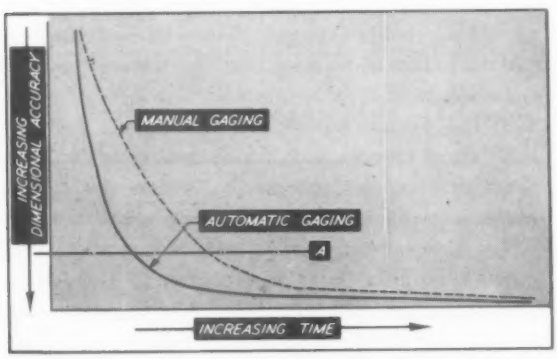

Fig. 8. These curves show the law of diminishing returns. Assuming line *A* to represent a production tolerance of 0.0005 in. or less, the intersections of the two curves with line *A* indicate the relative amounts of time necessary to work to the given limit *A*.

would hardly be able to deliver any great, or even noticeable shock. The electrical contacts in the gage are mechanically actuated by the free-moving micrometer plunger riding on the work. There are adjustment knobs on the gage in order that the limit contacts can be set as desired.

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The Federal gage can be placed on the work at any instant convenient to the operator. This is particularly convenient when the part to be ground may have a heavy scale on it, making it necessary to start the roughing cut previous to putting on the gage. The gage requires no cocking

Fig. 9. Gage blocks are shown being machine lapped. Timing alone governs the contact time and controls the cycle.

and can be placed right on the machine without stopping the machine.

The Foster gage is again found to have a mechanical electrical device with adjustable limit knobs on it. Whereas the Federal gage breaks and makes only a low-voltage circuit to obtain its control, the Foster gage, operating on 110 volts, makes the circuit. In the Foster gage, the sizing caliper does not directly make the contacts, but the impulse is transmitted mechanically into the gage, is mechanically reduced, and is based upon the movement of the sized block as seen between the two tungsten-carbide-faced jaws. Due to the fact that

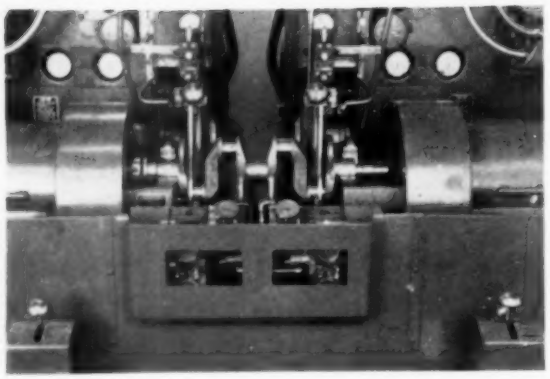

Fig. 10. These are the dual controls for a Twin-O-Matic crankpin grinder.

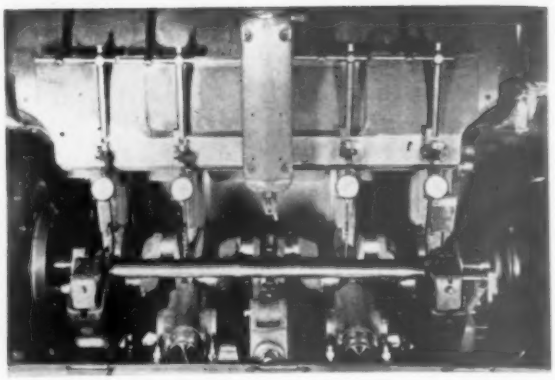

Fig. 11. These visual gages are used in a multiple setup as shown.

this plunger-type size block is used, the Foster gage has to be reset each time, or cocked, before it is placed onto the work.

The Landis gage is a mechanical micrometer plunger riding on the work, but electrical contact is transmitted to and controlled by air pressure. As the illustration shows, as the diameter of the work becomes smaller, the flow of air to a mercury column is restricted. As the restriction increases, a contact is gradually allowed to be made through a column of mercury. Triple-contact gages can be made on this same principle.

There is an additional type of control, comparable to the Size-matic control on an internal grinder, an example of which is the Norton model No. 6 CTU (semi-automatic) which operates on a control cycle, with varying feeds limited only by the practicability of the situation and automatic diamond dressing. There is a compensating device for wheel wear on this machine. Still other control cycles operate on only a timed cycle such as on the lapping machine shown in Fig. 9.

There are gages applicable for a wide variety of jobs. For example, properly designed automatic gages can gage outside diameters interrupted by gear teeth, splines or keyways. They can be applied to multi-headed machines (Fig. 10), as single- or double-contact automatic gaging, or visually multiple gaging. See Fig. 11. As mentioned before, automatic gages are used extensively in the race grinding industry and, again, are part and parcel of the control system that makes mass production of ball and roller bearings possible.

Some of the claims on which the manufacturers of gages appear to be in accord are: (1) The job of maintaining control is easier for an operator with a gage, visual only, or single or double contact. (2) There is an elimination of scrap, and the gages provide continuous inspection of the work. (3) With the use of the gage, an opportunity is afforded to the methods or time study department for re-evaluation of the job. (4) Standardization of cycle is possible. (5) With this standardization of cycle, wheel standardization becomes mechanical. (6) There can be a radical increase in production, due to all of the above factors. (7) Sometimes it may be possible to increase the number of machines one man can handle.

Shown here are primarily the advantages that can accrue to production grinders by using automatic size control wherever possible. All of the above gages do their job very well, and the choice between them is very narrow and may be perhaps stated in terms of their individual disadvantages.

TABLE II—GAGING TIME FOR A 5/16-IN. DIAMETER BOLT

	Fixed Stops Snap Gage Controls	Fixed Stops Standard Gage	Fixed Stops Setting Gage	Fixed Stops Indicator (Visual)	Automatic Gaging
Basic Time	2.48 min.	1.64 min.	1.58 min.	1.30 min.	0.75 min.
Percent Time as Compared to Automatic Gaging	330	219	210	173	100

The Federal gage requires a separate power source to supply the 12-volt current. The Landis gage requires an extremely sensitive constant-pressure supply of air. The Foster gage uses a 110-volt supply of current, which may or may not be considered good practice. The Foster gage requires cocking, which process, if forgotten, is important, but which becomes almost automatic to the operator while using the gage. There is validity in the statement that air gages are apt to be the most sensitive when properly maintained. However under normal conditions mechanical-electric gages are probably easier to maintain.

Now that the case for gages has been set forth, it will not be a simple matter to return to each production job and try to equip every machine with gages. Accurate gaging can only be applied to those operations where plunge cut grinding is done.

Statistical Evaluation of Rational and Stratified Methods of Sampling

By Dr. James V. Strela
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Part III

THE THEORETICAL considerations characterizing distribution of variable characteristics from the normal, or assumedly normal, process or population have been presented. In Fig. 4, the true standard previously established is pictured as a symmetrical bell-shaped curve within which the percentages of the values within the ± 1, 2, 3 zones of σ' are indicated. In the remaining section of the figure, the estimates of the same assumedly unknown standard are estimated by the following three methods:

(1) From an organized frequency distribution of 10 $n = N =$ 20, 50, 100, and 150 values, represented by the same four sets of ten samples of $n =$ 2, 5, 10 and 15 values, previously analyzed for the state of control and conformance to the past standard by means of the control chart method. The formula for σ (or σ') calculation of such organized frequency distributions is

$$(2b)\quad \sigma = \sqrt{\Sigma fX^2/N - \overline{X}^2}$$

which is but another expression of formula (2) already presented. If values X are grouped by a class interval larger or smaller than one and such class interval or cell is assigned the symbol i, formula (2b) reads

$$(2c)\quad \sigma = i\sqrt{\Sigma fX^2/N - \overline{X}^2}$$

This applies to coded values, such as, X = difference, d, of the true value minus the specification mean value (or any arbitrary value) set at zero on the dial gage, in the units, i, of the gage calibration. Thus (2c) above may be expressed

$$(2d)\quad \sigma = i\sqrt{\Sigma fd^2/N - (\Sigma fd/N)^2}$$

NOTE: On pages 65 and 66 of the September issue, the references to Fig. 2 should read Fig. 3 and the reference to Fig. 3 should read Fig. 4.

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(2) From the $\overline{X}$ and $\overline{R}$ of m subgroups of n values, based on the four sets of data previously analyzed (Formula 7).

(3) From the $\overline{\overline{X}}$ and $\overline{\sigma}$ of the same m subgroups of n values (Formula 11).

In all cases, the $\overline{X}^*$ ± 3σ values are plotted to correct scale and the values are recorded. The vertical thin lines at the top of the figure, extending from the $\overline{X}'$ ± 3σ', represent the known standard which, however, is now considered unknown. In the next to the last column of the adjoining table, the estimated percentages of the normal curve (which was previously found appropriately describing the distribution of the values from this supposedly unknown process) within the assumed quality specifications $\overline{X}'_{sp}$ ± ½ tol. = 0 ± 10.5 are also presented. Finally, in the last column, those percentages are expressed as the percentages of the 99.73 percent taken as 100 percent or base. The last curve on the bottom of the figure represents the combined sample of all 320 values.

Analysis and Interpretation of Data in Fig. 4. Note that all these estimates of $\overline{X}'$ ± 3σ' are excellent, chiefly because all these values come from a perfectly controlled process. Of principal interest here are value and applicability of the statistical tools used in these analyses. Thus it is gratifying to note that all 13 estimates of the same now again admittedly known process or universe are very much alike, in spite of the fact that they are based on three methods of estimation and four sample sizes. On the basis of the results of the application

* In the figure, the symbol $\overline{X}$ also represents the symbol $\overline{\overline{X}}$. ($\overline{\overline{X}} = \Sigma\overline{X}/m = \Sigma X/mn$ = Mean).

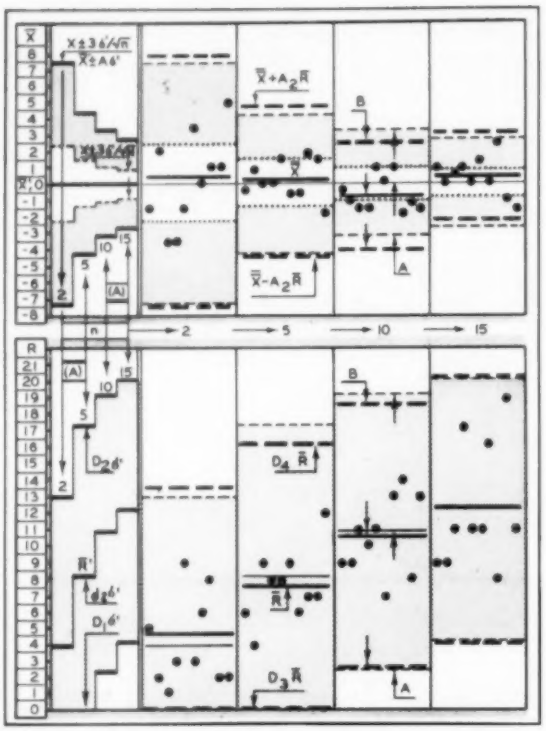

Fig. 3. These charts are based on known (A) and estimated (B) standards. (X', σ'-$\bar{X}$,R)

of these tools to the data under consideration, the following conclusions may now be made:

(1) From the sufficiently large number (m) of the averages and ranges (or sigmas) of n values giving an indication of a state of statistical control, the unknown standard may be estimated within a reasonable and acceptable error characterizing sampling procedures.

(2) This error decreases as the sample size increases, although this is not saying that a single larger sample must always yield a better estimate of its unknown population than a smaller sample.

(3) The state of control or the lack of it may be determined with 99.73 percent probability of a correct appraisal. (A state of statistical control implies process variability resulting from the operation of a multitude of the inherent chance causes of variation that cannot be eliminated. At best, they may be reduced, but only at the cost of a radical change of the process, such as, for example, completely overhauling a worn-out machine, or placing the process on a new machine. Lack of control exists when the process variability is the result of both chance and assignable causes of variation, only the latter being subject to economical detection and elimination. Quality is maintained at high level if assignable causes are constantly detected and eliminated to keep the process at a minimum of variability. For in the dimensional control of quality, the narrower the spread of the values produced, the higher the quality in terms of quality specifications.)

(4) A state of control may exist on any level of the values produced. However, since quality specifications are stationary, a perfect state of control on an undesirable level may still produce a substantial amount of substandard quality. In other words, a state of control is no warranty of meeting quality specifications. (The components of complex processes, such as, for example, the output from a multiple-spindle machine, may be in a good state of control, but if such state of control exists at various levels, even if the $\pm 3\sigma'$ of such component distributions are alike and smaller than the spread of the tolerance, the tolerance is still likely to be exceeded.) Under such conditions, the method of sample selection must be considered more carefully than in the case of a simple operation such as is characterized by the Thompson sampling machine when operated on the horizontal plane. It is this condition which now will be considered.

Adverse Effect of the Continuous Shift of the Process Component Distributions on an Assumed Quality Specification

Fig. 5 emphasizes the adverse trend of the shifting process components on the quality of the values produced to quality specifications which are assumed to correspond to the natural limits of variability evidenced by the Thompson sampling machine when operated on the horizontal plane, represented in the figure by the component A. Here, however, the figure will be used as a starting point for the preliminary considerations of the rational and stratified methods of sampling.

The schematic picture of the situation illustrated by Fig. 5 may seem exaggerated, for it illustrates that as much as 50 per cent substandard quality may be produced by allowing the process component A to shift gradually into the subsequent process components B to G inclusive. Shop people are also likely to say that the assumed specification is too tight for this situation even if no shift due to, for instance, tool wear, took place. To be sure, the specification, because of its relation to the $\bar{X}' \pm 3\sigma'$ of the component A with which it coincides, is not most economical, for it does not leave room for any shift of the initial process average, $\bar{X}_a$. Consequently, if such a shift is natural to the process, the tolerance should be widened if it is permissible to do so from the engineering viewpoint; otherwise, a 100 percent inspection must be initiated.

The facts just stated are important but beside the point, since the principal aim is in developing a method of sampling that would quickly detect the situation illustrated. At the same time, it may

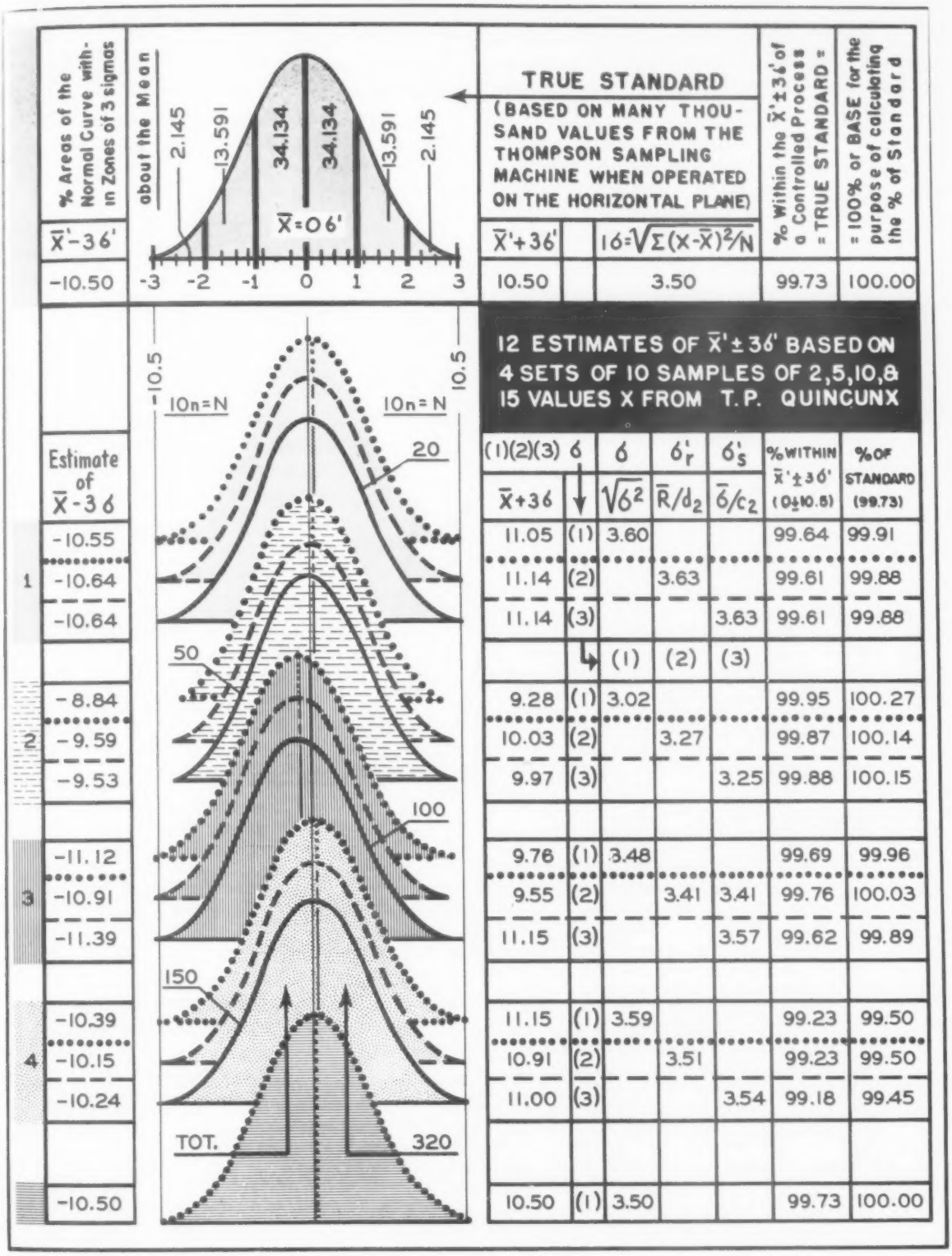

Fig. 4. Comparison of the true standard ($\bar{X}' \pm 3\sigma'$) and its available estimates ($\bar{X} \pm 3\sigma$)

be of interest to those unfamliiar with machining operations that results portrayed often prevail even on simple operations characterized by no definite trend and on jobs with liberal tolerances. Furthermore, such results are produced by very conscientious operators or floor inspectors who, however, have no knowledge of the statistical pattern of the values produced. Therefore, the situation will be analyzed from the viewpoint of two operators interested in producing quality values, one using the

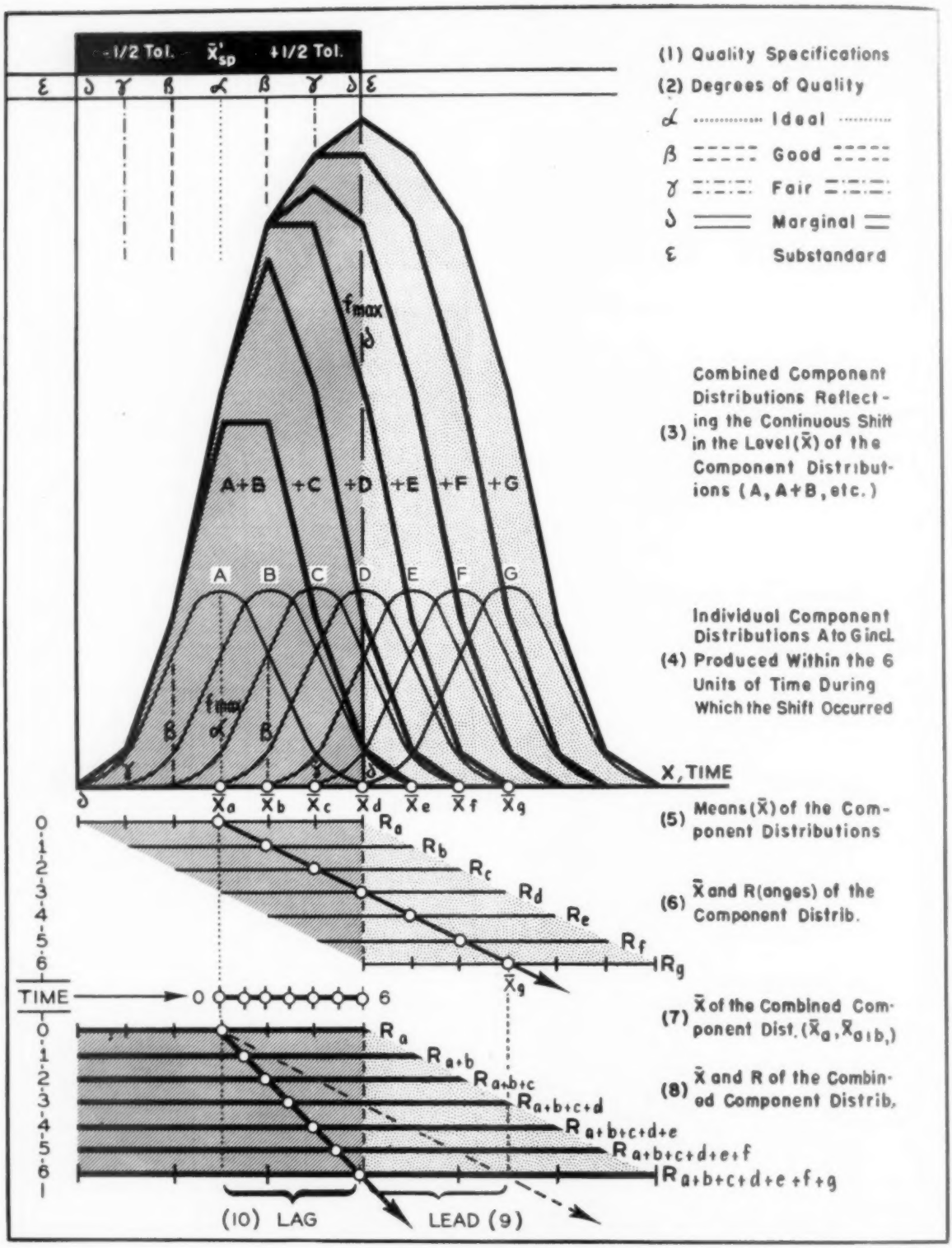

Fig. 5. Adverse effect of the continuous shift of the process component distributions on an assumed quality specification.

knowledge of quality control technique, the other using no such technique or, at best, using a single large sample out of the production of values, such as pictured by the last combined curve in the figure composed of the seven component distributions.

Rational Method of Sampling. For sampling to be sensitive to the detection of the gradually (or suddenly) changing levels of quality represented by the average values produced. such as represented by the symbols $\bar{X}_a$ $\bar{X}_b$, . . . to $\bar{X}_g$, in the figure, it is

obviously necessary to take such samples in the time sequence of their production. For if values of a controlled process distribute normally, then even small samples from such processes will be composed of values from the area of their greatest concentration, i.e., from the $\overline{X}' \pm 1\sigma'$ within which there is 68.27 percent of such values, or from the zone of $\overline{X} \pm 2\sigma'$ of their dispersion within which 95.45 percent values are distributed. Furthermore, since the normal distribution is symmetrical, such averages are likely to alternate fairly regularly about the trend of the shifting level of the process component distributions, such as is illustrated in Fig. 5 by the straight line running through the theoretical shifting averages of the component distributions *A* to *G* inclusive, illustrative of the progressive tool wear, progressive weakening of the plating solution, of progressive increasing or decreasing temperatures, etc., depending on the characteristic under consideration. Consequently, such averages are very likely to move quickly to only one side of the original level, such as represented by the $\overline{X}_a$, and that situation is an indication of a departure from the original level of operation. In other words, while such averages of, for example, samples of five values will not form a perfectly straight line as pictured, a trend line fitted to them will be a straight line and the steepness of its slope will be a reflection of the speed with which the component distributions keep moving to a higher level. Consequently, assuming a much wider quality specification than pictured, it would then be possible to determine how far such progressive tool wear was permissible before producing substandard quality. The modified control chart limits for averages, which are not considered here, are based on this consideration.

Now since the extent of variability about such shifting levels of the component distributions is also of interest, the trend of their averages must be complemented by either ranges or standard deviations about them. For if the control chart for ranges is as sensitive to the detection of the state of control and to the conformance to a past standard of variability as is represented by the uniform spread of the base of the seven schematic curves in the figure, the magnitude of such ranges will show no definite trend or appreciable fluctuation. Consequently, they should indicate a state of control such as previously illustrated.

Naturally, ranges of small samples will be considerably smaller than the complete range of the whole component distributions; nevertheless, they will be more or less symmetrically located about the moving trend of the means of these component distributions and will show a remarkable degree of stability. In other words, from the averages and ranges of such samples, it should be possible to have at all times a remarkable audit of quality and of its trend. Consequently, such a trend can be allowed to continue only to a maximum point determined from the relationship between $\pm 3\sigma'$ of the original controlled component distribution and the spread of the assumedly wide quality specification.

Stratified Method of Sampling. A large sample of, for instance, 100 pieces is taken out of the total production of the combined distribution such as pictured in Fig. 5 by the combined curve embracing the seven component distributions. Very likely, the average of such a sample gives a good estimate of the true mean of the whole process distribution. Also assume that the man who takes this sample knows how to calculate the standard deviation and that he uses the $\overline{X} \pm 3\sigma$ of the sample as an estimate of the process variability. He will very likely again secure a pretty good estimate of the over-all process dispersion and thus of the bad results in reference to the narrow specification pictured. However, if the function of the statistical analysis were merely to confirm the bad results of the past conditions such as pictured, and which may be readily ascertained as bad, statistics would be of limited value. But since the statistical method is always based on numerical values pertaining to the results obtained, more must not be expected of the method than it can do. If in the rational method of sampling (item 6) an estimate is made of the $\overline{X}' \pm 3\sigma'$ of the component distributions as the process progresses from the component *A* to the component *G* and in the second case of the stratified sampling (item 8) of the $\overline{X}' \pm 3\sigma'$ of the combination of these component distributions, the same method of analysis is used; but the manner in which the two sets of data are organized into the samples of *n* values differs. There are two types of samples:

(1) Those in which the sequence of occurrence of the values is preserved and which are thus sensitive to revealing the changes taking place as time progresses (rational sample).

(2) Those in which such time sequence is obliterated along with the component distributions spaced by the time intervals (stratified sample).

A representative stratified sample in which values from all process components are represented of necessity reflects the variability resulting from both the chance causes of variation characterizing each component and the possible causes of increased variation due to the changing or permanently different levels of the component distributions. Consequently, ranges of even small samples from such combined processes will likely be considerably larger than of the samples of the same size but from the unmixed individual component distributions.

Obviously, there is no argument about the statistical method applied; it is rather about the method in which the data are selected, the first being suit-

able for the detection of the developing quality trends, the other being insensitive to it. For in the second case, although the quality trend of the combined output, such as illustrated by the slanting heavy line under item 8, is actually developing, since a sample is not taken until such trend has progressed to the level of the last component, there is no developing picture of that trend. In short, the analysis of the large sample in which all seven layers, strata, components, or whatever the most appropriate term, are represented is likely to give a good estimate of the average quality and of the variability about it; but such an analysis will tell absolutely nothing concerning what that average quality and degree of variability about it might have been if the process had run another course than that pictured in Fig. 5, and about which nothing would be known. For, in this case, no previous sampling is assumed, so that it might not even be suspected that the process average and the overall process variability could have been anything but as revealed through the analysis of the single large sample.

From a statistical analysis thus secured, it could hardly be said that the process or machine capability has been determined. The $\overline{X} \pm 3\sigma$ of such stratified samples merely represents the estimate of the existing variability; it does not usually represent the minimum amount of variability attainable at some other level of operation. On the other hand, the $\overline{X}' \pm 3\sigma'$ of the component distributions, even precisely determined, does not represent the actual variability of the complex process pictured; that variability constantly increases even if the $\overline{X}' \pm 3\sigma'$ of the process component distributions remains unchanged. For the $\overline{X}' \pm 3\sigma'$ of the process components moves along the scale of values; consequently even a process characterized by a wide tolerance is likely to exceed that tolerance if the shift as pictured is permitted to continue. Thus when an estimate is made of the $\pm 3\sigma'_r$ from the $\overline{R}$ of the rational samples in which the time sequence as well as the identity of the component distributions are well preserved, the result is the $\pm 3\sigma'_r = \pm 3\overline{R}/d_2$, which, at best, represents the potential process capability or variability, provided no trend of such components takes place. By inference, therefore, the $\pm 3\sigma_{\overline{x}}$ chart limits based on the $\overline{R}$ of the rational samples from the component distributions are likely to be too narrow to accommodate all sample averages characterized with a definite trend. Consequently, that method of sampling will be sensitive to the detection of an undesirable trend or of a sudden shift in the level of operation, such as produced by the tool chip, tool slip, sudden increase or decrease of temperature, of the strength of solutions, etc., depending on the type of characteristic under consideration.

Vice versa, the average range of the stratified samples is likely to increase so much that the $3\sigma_{\overline{x}}$ limits about the composite grand average $(\overline{\overline{X}} \pm A_2 \overline{R})$ will be insensitive to the detection of a hidden undesirable situation. Furthermore, since in such a case the chance and assignable causes of variation will be constantly mixed, they will combine into a new stable system of causes of variability which will have every indication of a state of control characterizing the distribution of values produced by the chance causes of variation; consequently, they will likely indicate a seemingly perfect state of control.

(Continued next month)

Shell Molding Process in Production

AFTER MORE than a year of experimental and development work with precision castings by the shell molding process, including actual production runs, Powdered Metal Products Corp. of America has announced availability of production facilities for precision castings made by the shell molding process. The line will be marketed under the name Die Mold Castings.

The process, said to produce precision castings at or near the cost of ordinary sand castings, requires production of precision dies. In fact, the need for precision dies as opposed to wooden patterns is one of the principal differences between the newer process and conventional sand casting. An expendable, semi-permanent mold of sand and plastic then is produced from the die for conventional pouring.

The tooling facilities already required by the company for the complex die fabrication involved for its powder-metal products, Powdered Metal found, were ideally suited to the much talked about new process. This situation permitted fast and practical application of shell molding to industrial needs.

Job-Tests Aid Production Personnel

By Joseph E. King
EXECUTIVE DIRECTOR
INDUSTRIAL PSYCHOLOGY, INC.

Part II

A second phase of testing applies to present employees. Studies indicate that about one-third of the employed population is misplaced on the jobs they are doing. Either their aptitudes are unsuited for their present jobs, or they have too much aptitude for their present jobs and would be better at more complex tasks. Fig. 5 shows the results of a study of 72 production workers. The employees were first ranked in terms of their job performance or efficiency. In this ranking, production data were available in terms of daily averages of units produced. Next they were given the semi-skilled battery of job tests, the same tests which are taken by applicants. The graph in Fig. 5 shows the relation between their Q (qualification) scores on the tests and their production efficiency. Note that in general those employees who were producing at a below-average figure were found independently by the tests to be UQ (underqualified) and Q1 (minimum qualified), and those employees who were producing in the 160- to 200-unit bracket tested at Q2 (average qualified) and Q3 (well qualified) levels.

The average efficiency score at the four levels of qualification was as shown in Table III.

Low Aptitudes and Poor Performers. The factory manager took action on the UQ and Q1 workers whose daily production average was 120 or below (indicated by the solid circle in Fig. 5). These workers were transferred to jobs for which they were better fitted. For example, one man who had been working for four years as a production worker was found to have excellent inspection aptitudes but no coordination aptitude to speak of. Three months after he was transferred from the production job to an inspection job, he was one of the top producers and had almost doubled his take-home pay. All of these low-aptitude low-production workers were replaced by workers who qualified on the tests at the Q2 and Q3 levels. Actually, only nine new employees were needed to replace the 15 transferred men and still maintain the same production. Of the 15 workers, 11 were found to have aptitudes which fitted them for other factory jobs, and jobs in which they eventually became more efficient workers.

High Aptitudes and Good Performers. The workers who scored in the Q2 and Q3 test levels and whose daily production averages were between 180 and 200 units are the ideal employees (indicated by the solid square in Fig. 5). They not only have the aptitudes for the job, but are using these aptitudes in a very efficient manner. Interestingly enough, some of these workers were being taken for granted by their foremen. The foremen were prone to concentrate their attention on the workers with low production in the hopes of raising their efficiency. This is a most desirable foreman practice, providing the workers so encouraged have the aptitudes to

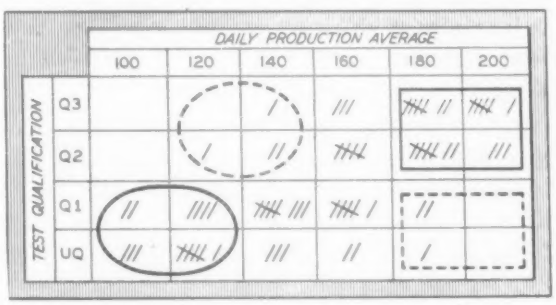

Fig. 5. Plotted here are the results of tests given 72 production workers. Code: Solid circle, low aptitudes and poor performers; solid square, good aptitudes and good performers; dotted circle, good aptitudes and average performers; dotted square, poor aptitudes but good performers.

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TABLE III—EFFICIENCY SCORES COMPARED TO QUALIFICATION LEVELS

Test Qualification Level	Description	Average Daily Production Efficiency
Q3	"Well Qualified," and an excellent risk.	182 units
Q2	"Average Qualified," and a better-than-average risk.	169 units
Q1	"Minimum Qualified," and recommended only in a tight labor market.	141 units
UQ	"Underqualified," and not recommended for place in this job area.	128 units

do the job. However, such attention to UQ and Q1 workers is a waste of time. The testing served at least one purpose for these efficient workers. They began to receive the recognition they deserved, because in supervisory training session the supervisors soon saw their error in coddling the poor workers and ignoring the good employees.

High Aptitudes, but Average Performers. The workers who scored in the Q2 and Q3 levels on the tests and were performing at the 120 to 140 unit level (indicated by the dotted circle in Fig. 6), needed further individual study. They have the aptitudes, but are not using them. Actually three of these four workers were overqualified (had too much aptitude) for the semi-skilled worker job, and were earmarked for advancement into the skilled worker area. This status (high aptitudes but average performance) may be due to too much aptitude, or to such other causes as personality traits which conflicted with the job, lack of initiative and drive to do that type of work, improper supervision, and other factors which are measured only indirectly by the aptitude tests.

Low Aptitudes but Good Performers. The dotted square indicates workers who had very little aptitude, but were doing a creditable job. In individual case studies of these three workers, it was found that they were older employees, and the job had become completely automatic to them. Were they to be transferred to new jobs, they would undoubtedly fail miserably. Employees who are good performers but show up on tests as lacking aptitudes for the job are few and far between.

Follow-up of Job Applicants

Another type of study was to follow up job applicants to determine how well they learned the job and performed in relation to their test qualification level at the time of hiring.

In one study of 38 girls who were hired for inspection work in a watch factory, all of the girls were tested when they were hired, but the tests were not used to screen or place them. These employees all went into inspection jobs where production units could be counted. An engineering standard had been set up for the training period, and the employee had to produce 113 units per hour for five days to reach the expected earned wage rate and complete the training period. The normal time to complete the training, as set by the engineers, was ten weeks. Of the 38 new-hires on this job, seven tested at the Q3 (well qualified) level, and their average time to meet the training standard was 7½ weeks. Eight employees tested as Q2 (average qualified), and their average training time was 6 weeks. Actually, the Q2 employees were better performers than the Q3 workers. This was due to the fact that some of the Q3 employees were overqualified, actually having more aptitude power than this job demanded from them, and thus became lax in their production. Thirteen employees were Q1 (minimum qualified), and they required as a group 11 weeks to meet the training standard, or one week more than the engineering department had set. Ten employees tested at UQ (underqualified). Of these ten, four were discharged during the training period. Of the other six, two required 14 weeks, one 13 weeks, two 11½ weeks, the sixth 10 weeks.

Had the company been using the tests at the hiring level, the ten UQ workers would not have been hired, and the thirteen Q1 workers probably not hired. Each week spent on the training curve cost the company $61.00 per employee. The testing method to decrease training time paid off in very tangible dollars and cents.

A Practical Program of Testing

Studies of employees in various types of jobs and in various types of companies has now progressed sufficiently that two important facts are known: (1) what aptitudes are needed in the basic job areas, and (2) how these aptitudes should be combined to give an overall score indicating applicant job risk.

Short aptitude tests, designed for business and industry, interesting to adults, and studied in relation to employees actually employed on various types of jobs, have been developed. Combined in specific job tests, they have proved most useful.

The weighted score grid of these job tests has been designed to simplify the interpretation of test scores. The grid automatically weights the applicant's tests, provides a total weighted score which can be translated into one of four qualification levels as based on industry-wide standards, and provides an objective statement of employment risk and future productivity on a certain job.

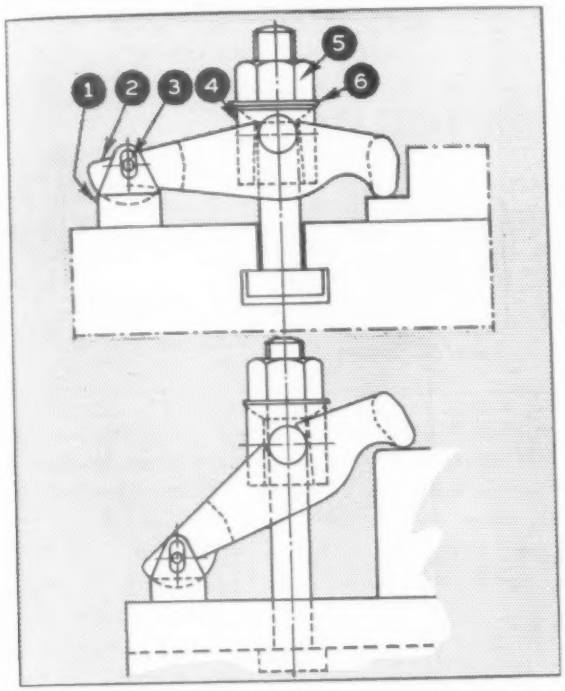
Aptitude tests can be used today with confidence. These job tests can be easily tested against the production records of present employees. The job tests provide the answer for the small and middle-sized company, or even for the large manufacturing organization, on how to get their testing program started, and to derive the benefits of selection and placement of employees according to aptitudes.

Gadgets

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Universal Clamp

This universal clamp has three clamping points. The tension or strain on the screw bolt is always perpendicular because of the movement of the washer and the pivoted clamp. In the accompanying sketch, detail 2 is the clamp body made in one piece



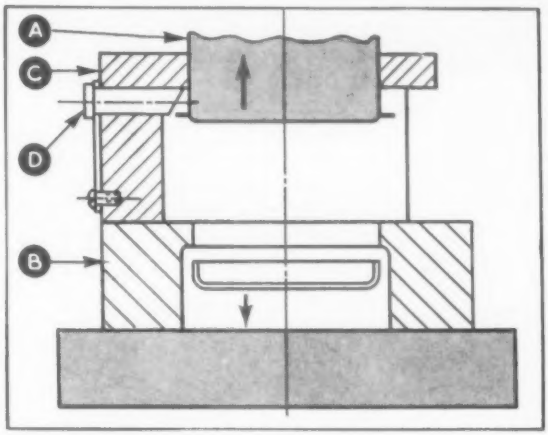
from forged steel. Item 4 is a square piece with one turned pivot on each side, and with a spherical surface. The clamp, item 2, has a ball-shaped surface on one end and two points on the front end. Detail 6 is a washer with a spherical surface to fit the spherical surface on item 4. Item 5 is a nut.

Hjalmar Dahl
Upplands Väsby, Sweden

Scrap Ejector

In shallow cup trimming dies of the drop-through type, air ejection of the scrap may be used to best advantage in conjunction with a stripper of the spring or elevated type. However, where air is not available, V-shaped scrap cutters are usually employed. This results in scrap strewn over the die which must be constantly cleared away. One way to eject the trimming in one piece, eliminating scrap cutters, is illustrated here.

The die shown includes punch *A*, cutting edge

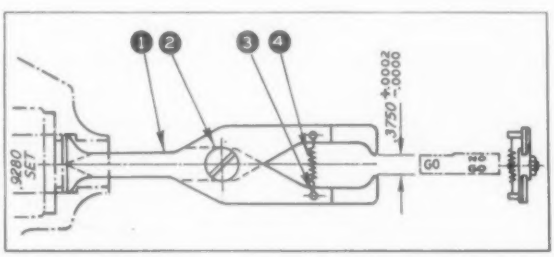


B, and elevated stripper *C* with one side open. A spring-backed cam plunger *D* made of drill rod and hardened is mounted in the stripper just outside the path of the trimming punch. The upper edge of the plunger is in a plane with the stripping surface. The trimming, which adheres to the punch on the way up, pushes the plunger outward by riding on its beveled end. The instant the trimming scrap is cleared from the punch by the stripper, the plunger springs back, shooting the scrap clear of the die.

N. Schwartz
Jackson Heights, N. Y.

Scissors Gage

Scissors gages such as shown in the sketch are used to measure inaccessible diameters or contours. The arms shown at point 1 are usually made of ground flat stock with the ends bent slightly to bring them opposite each other. Point 2 is a shoulder screw used to obtain a sliding fit between the arms. At point 4 is a tension spring to keep the arms apart.



The gage is inserted into the part and a feeler gage is used to check the dimension on the right-hand side. The feeler gage is ground to maximum and minimum dimensions.

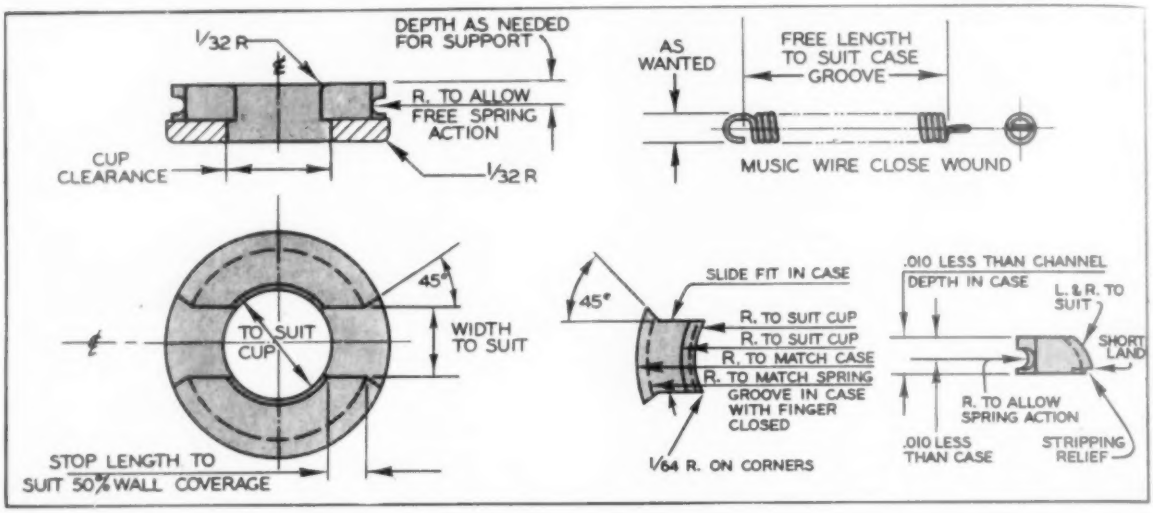
George B. Angelo
Boston, Mass.

The Tool Engineer pays regular page rates for accepted contributions to these pages, with a minimum of $5.00 for each item.

Supporting Strippers

When using floating carbide sizing rings in conjunction with a top forming die and conventional split ring strippers, considerable difficulty or breakage is encountered through inadequate die support. This is especially true in gang set-ups where space is limited and the die OD cannot be extended.

The fingers are smoothed with emery cloth, b the approach angle and land are polished. A sma radius on side corners of angle and land will avo marking of cups. The spring groove should deep enough to allow easy action when finger in a back position and flush with or slightly outsi the groove in case the finger is in a forward pos


1/32 R
DEPTH AS NEEDED FOR SUPPORT
R. TO ALLOW FREE SPRING ACTION
CUP CLEARANCE
1/32 R
AS WANTED
FREE LENGTH TO SUIT CASE GROOVE
MUSIC WIRE CLOSE WOUND
45°
TO SUIT CUP
WIDTH TO SUIT
STOP LENGTH TO SUIT 50% WALL COVERAGE
SLIDE FIT IN CASE
45°
R. TO SUIT CUP
R. TO SUIT CUP
R. TO MATCH CASE
R. TO MATCH SPRING GROOVE IN CASE WITH FINGER CLOSED
1/64 R. ON CORNERS
.010 LESS THAN CHANNEL DEPTH IN CASE
L. & R. TO SUIT
SHORT LAND
R. TO ALLOW SPRING ACTION
.010 LESS THAN CASE
STRIPPING RELIEF

The stripper illustrated provides suitable stripping and die support, with the added advantage of adaptability to a number of sizes by simply inserting a set of fingers with length and radii suitable to the cup size. Adaptability is limited only by the cup clearance hole diameter and the amount of die support necessary.

The hardened case, having the same OD as the forming die, eliminates multiple step jig boring and a hardened support insert. It need only be surface ground on the top and bottom flat surfaces; the finger channels are smoothed with emery cloth. Case dimensions are obviously controlled by cup size, support required and length of press stroke.

tion, to assure proper tension at all times.

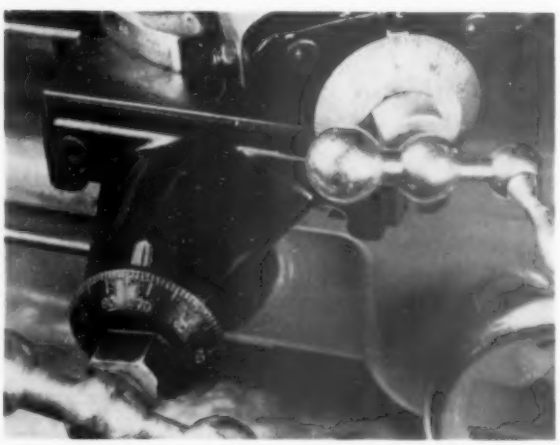
Finger length and stop angles must be figured so that contact is not made with the draw punch; however, at least 50 percent or more of the cup wall should be covered to provide adequate stripping. The thickness of the fingers should be slightly less than the depth of the case channel to allow free movement. When making the fingers it is advisable to use stock turned to the same diameter as the case and having suitable thickness. In this way, one set or more of fingers can be accurately machined simultaneously.

W. V. Anderson
Torrington, Conn.

Improving Dial Visibility

Some small machine tools, such as bench lathes, are now fitted with die-cast micrometer dials with figures and graduations in relief. It is usual to leave these dials in the dull as-cast condition because the glare is reduced and visibility is improved. But since the figures have the same color as the parent metal of the dial, visibility is not too good.

The readability of the dial figures and graduations can be increased considerably by a very simple treatment. The whole dial is painted with a dead black paint and, when dry, the surfaces of the figures and graduations are scraped clean. The scraped parts show light against the dark background and can therefore be seen much more clearly. The dial in the lower left of the illustration has been treated in this manner while the one at the



upper right is as-cast. The effect of the treatment is self-evident.

F. E. Riley
London, England

Westinghouse:

Engineering on Call

By Gilbert P. Muir

WESTINGHOUSE ELECTRIC Corporation believes strongly in centralized manufacturing engineering assistance to its manufacturing divisions, and believes in letting the divisions chalk up the savings and assess their worth.

Headquarters manufacturing engineering at Westinghouse dates back to the mid-thirties, when the company felt a need for a centralized headquarters group to serve manufacturing divisions with information or assistance on new production techniques or on manufacturing problems with which a particular division might not be familiar. In addition, management felt that such an organization would offer a means of tying together for the overall benefit of the company related manufacturing operations carried on in the various divisions.

Envisioned as a staff activity to undertake specific projects or work on general applications, the division expanded its operations in the mid-forties to include what is now an extensive research laboratory which represents the largest departmental activity of the headquarters manufacturing division.

By Westinghouse definition, manufacturing engineering is "the art or science of guiding the conversion of raw material into the manufactured product by the most economical process or method possible under prevailing conditions and requirements." This includes such requirements as desired quality with existing conditions such as labor rates prevailing at the time.

W. H. Dickinson, manager of Westinghouse Headquarters Manufacturing engineering.

All manufacturing operations, including such items as foundry practice, packaging and materials handling, are included in manufacturing engineering, as well as tool engineering, which Westinghouse considers an integral part of manufacturing engineering.

Westinghouse's headquarters manufacturing engineering department provides assistance to the operating divisions in a variety of forms. Some of these include:

(1) Consulting service to the divisions on specific manufacturing problems.

(2) Research on various phases of manufacturing, including processes, methods, tools and equipment.

(3) Establishment and maintenance of standards pertaining to manufacturing processes and equipment.

(4) Serving as a hub for the dissemination of ideas and information to the operating divisions on manufacturing developments within and outside Westinghouse.

To handle this job the department utilizes two complete laboratories. The main lab, generally titled metals forming, is located at the department's headquarters on Pittsburgh's Ardmore Blvd. The metals-joining lab—a complete facility in itself, occupies a building at the East Pittsburgh works of Westinghouse, where adequate power is available.

Metals forming is rather a catch-all designation and includes press-working, metal-cutting and grinding, finishing and painting, plating, plant layout and materials handling.

Director W. H. Dickinson, describing the functions of his staff, points out that operation of laboratories is

not the purpose of headquarters manufacturing engineering — the prime function is technical assistance to the divisions, and the lab is a means to that end.

"We believe," he states, "that to learn of or develop a better cutting method doesn't do the Corporation any good as long as that knowledge is confined to the laboratory. The information benefits the Corporation only when it is put into use in those divisions making related products."

Basic concern of the department in selecting a project for study is the overall benefit to the company, whether the problem is a specific one applying to one division or a general one applicable to several. Since with a limited headquarters staff there is a continual backlog of projects recommended by the various divisions, a careful estimate must be made of the possible savings resulting from an investigation as compared to the cost of the study.

The Projects

Organization of headquarters manufacturing engineering is divided generally into development and applications groups. The former involves studies of new processes or methods as a type of manufacturing research activity, while the applications groups are more directly concerned with projects which have an immediate application at one or more manufacturing divisions.

Much of the work of the development groups is of a long-term, continuous nature, such as studies of cutting fluids and coolants which may go on for a period of several years. These groups work closely with manufacturers in the equipment fields, and undertake studies on new machines or processes for the benefit of the operating divisions.

Applications problems come to the lab from the interested divisions, and are screened for acceptance by an informal committee consisting of Dickinson and those staff members at the lab into whose province the problem falls. Since the laboratory staff represents only a small percentage of the engineers located in manufacturing engineering departments of the various operating divisions, its efforts are restricted to those problems which are outside the normal scope of the divisions. A division may, for example, encounter unfamiliar problems in connection with a new apparatus design which necessitate outside consultation. The lab can respond with a small crew of specialists who can aid in getting operation rolling.

Metals Forming

Facilities at the metals-forming lab include light and heavy machine shops, with lathes up to 30-inch capacity in the latter; a 300-ton hydraulic press; complete toolroom facilities; and a major deburring setup which includes belt, brush and grit equipment. In addition there are a paint installation with both steam and electrostatic spray equipment.

Development Section

Development activities at the lab include general manufacturing research with wide possible use as well as research on specific problems. An important part of the informational job of the lab is keeping in touch with manufacturing developments in industry and among the equipment builders, and in turn evaluating these for utilization by various divisions.

Some examples of the latter activity include studies made and being made on electro-mechanical machining, jet lubrication in machining, rubber-pad press forming and steam and electrostatic paint spraying. These studies often are carried out with the cooperation of the equipment producer, and frequently result in design modifications which studies indicate are desirable.

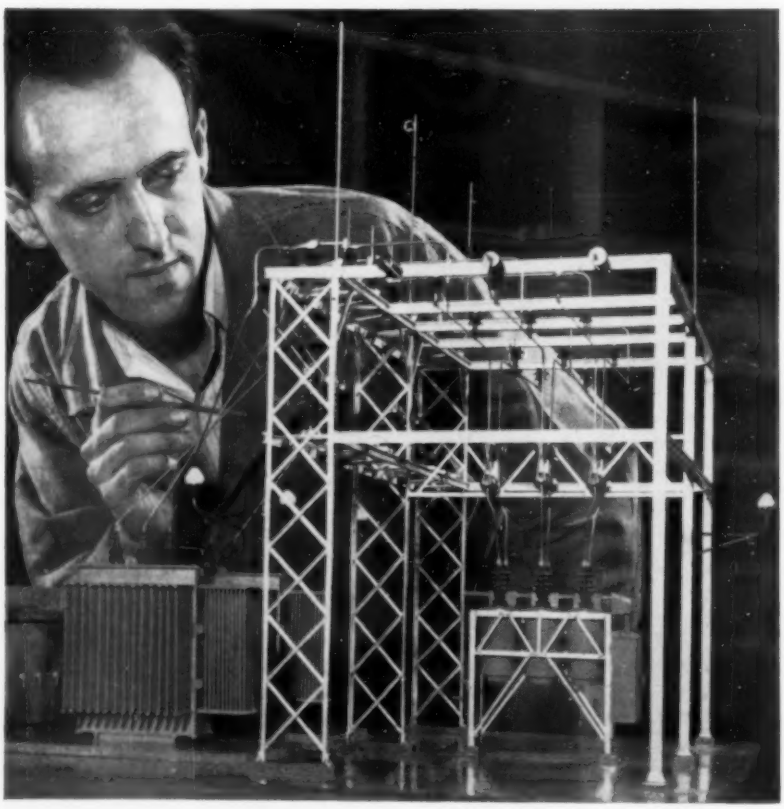


Fig. 1. An expert model maker puts the finishing touches on a half-inch scale model of an electric power substation. Lab engineers use his models to help plan more efficient plant layouts and product installation procedures. Solving such problems in miniature often saves time, money and materials.

Fig. 2. A machinist making some lab studies on the machining of molybdenum. The information he gathers will be disseminated to the interested divisions throughout the company.

Such studies on processes and machines are made to determine where, when and how the method may be applied profitably to company operations. Director Dickinson interestingly points out that even when no investigation of a process indicates it to be unsuitable for Westinghouse applications, the time invested is still indirectly beneficial to the company because it avoids independent studies of the same process by several Westinghouse divisions.

Some programs of investigation, as mentioned before, cover periods of several years. A study about to get under way will attempt to evaluate various factors involved in die design and operation, and may run up to five years. Programs on single point high-speed-steel and carbide-tipped tools have aimed, for example, at improving specifications for relief angles on tools—the best angle, if any, for a certain job, as well as how much difference a range of, say three degrees makes in performance of the tool.

Another function of the development group is tool design. Work ranges from simple cutting tools through more elaborate jigs, and fixtures to complete machines which are often built and test run at the laboratory. The intention is to eliminate as many bugs as possible from work of this nature in a location free from the compelling influences of production. Here again, Headquarters undertakes only those jobs which are beyond the scope or temporarily beyond the capacity of the operating division involved or of such widespread utility as to warrant the cooperative efforts of several divisions.

Applications Section

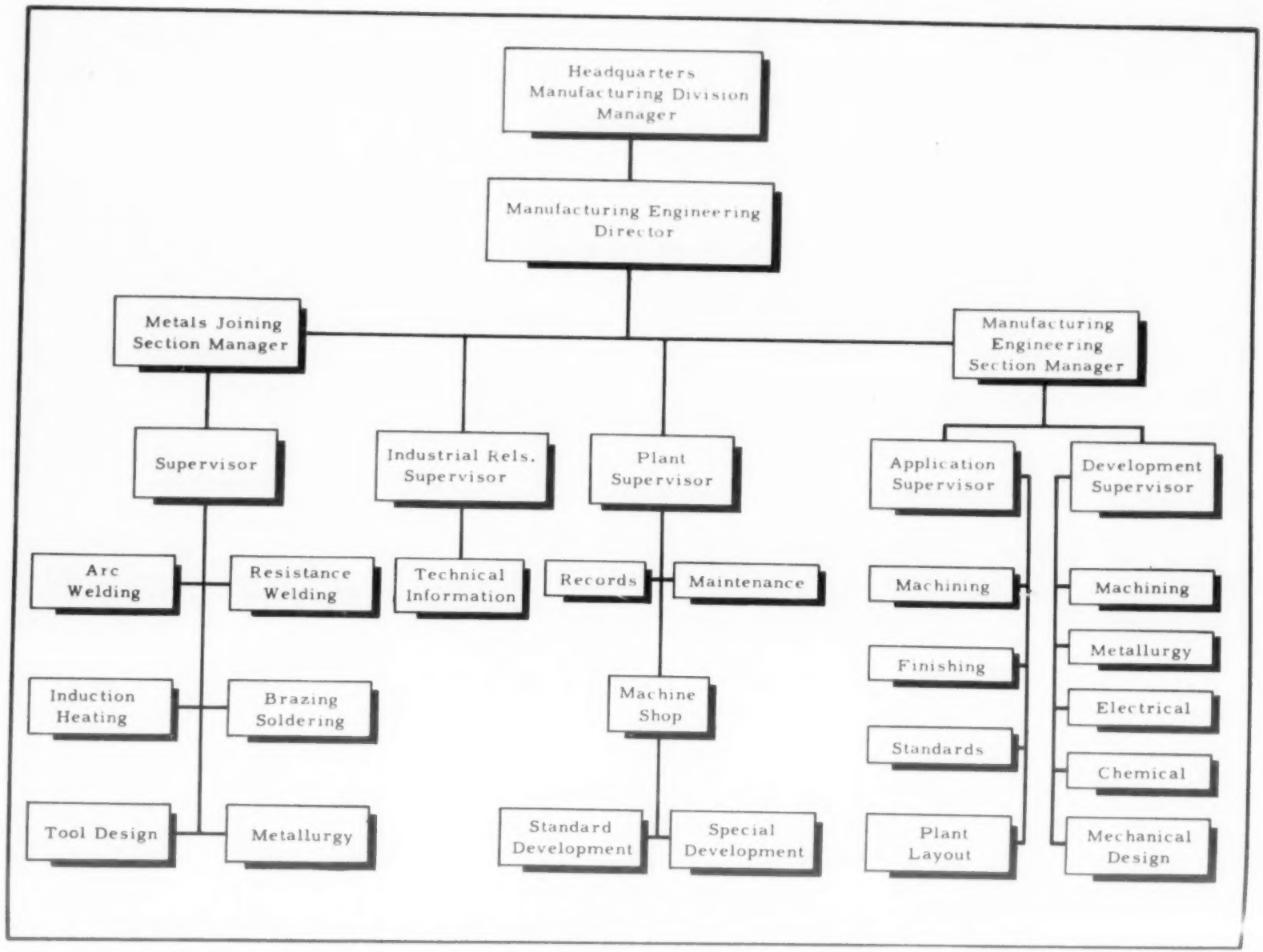
Two operations of basic importance to Westinghouse are plant layout and materials handling—particularly important at present with a Westinghouse expansion program which is scheduled to total about $300,000,000 in new facilities.

Some Westinghouse divisions have enough normal activity in plant layout through frequent operations changes, etc., that an adequate plant layout staff is permanently maintained. Such a division can carry virtually all the load in laying out a new plant and requires only general consulting assistance. In other divisions where changes in layout are seldom necessary, considerable aid might be required in approaching a layout for a new plant. The operating division is familiar with its production and equipment problems, and headquarters manufacturing engineering supplies the layout experience.

Again, the services of a centralized agency such as this must be restricted to general consultation for the most part. As Dickinson points out, it is generally less expensive to the Corporation for the division to have an engineer on their pay roll equipped to handle manufacturing engineering problems when the particular activity justifies it, than to send out a laboratory specialist. By way of clarifying this comment, the Corporation's aim is to keep manufacturing problems, whenever possible, at the divisional level, with an adequate staff to handle such problems. Where problems of an unusual nature occur, or problems arise which relate to more than one division, headquarters manufacturing engineering performs its function.

Closely related to plant layout is materials handling, an item which Westinghouse recognizes as being of major importance in controlling production costs. Dickinson prefers to work very closely with manufacturing engineers of the division when a new plant is being planned, since naturally any significant change in materials flow or handling after the plant is in operation can prove not only expensive but difficult.

The development of Westinghouse standards for tools and expense materials has represented substantial savings for the Corporation. This


Headquarters Manufacturing Division Manager
Manufacturing Engineering Director
Metals Joining Section Manager
Manufacturing Engineering Section Manager
Supervisor
Industrial Rels. Supervisor
Plant Supervisor
Application Supervisor
Development Supervisor
Arc Welding
Resistance Welding
Technical Information
Records
Maintenance
Machining
Machining
Induction Heating
Brazing Soldering
Machine Shop
Finishing
Metallurgy
Electrical
Standards
Chemical
Tool Design
Metallurgy
Standard Development
Special Development
Plant Layout
Mechanical Design

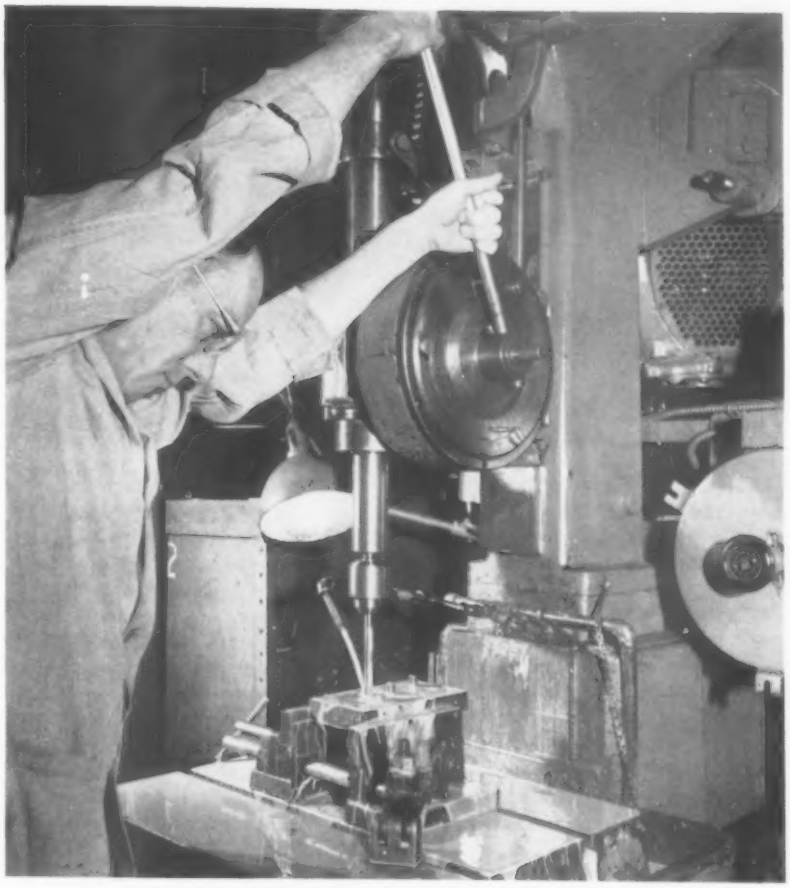


Fig. 3. An engineer runs some lab tests on the drilling of hardened tool steels with carbide tipped twist drills.

function of the metals-forming section is carried on at the Corporation level, with close cooperation between the lab and all directly concerned divisions. Continual liaison with the operating divisions results in practical, useful standards which best meet the needs of the majority of divisions and which serve as a basis for modification for those divisions with special needs.

Cutting tools have, of course, come in for a substantial amount of standardization effort. As one aid, manufacturing engineering furnishes to the divisions standard tool tracings complete except for dimensions. With only dimensions required before sending the print to a vendor, the plan encourages the use of standard tools.

Continual observation of various tools used in the company has permitted elimination of some company standards which have become obsolete, and concentration on developing standard sizes and shapes has resulted in an overall tool plan enabling one plant to reduce its tool sizes and shapes from 1500 to 350.

A sampling of applications projects from the metal-forming group's files involves a variety of manufacturing processes and techniques. Development of a fluteless drill promises substantial benefits in drilling plastic, slate, asbestos, and Micarta.

A typical lab job was a request from a Westinghouse division for technical assistance in developing techniques for machining and grinding titanium. Manufacturing engineering received samples of the part and experimented at the lab with various drills, grinding wheels and milling cutters. Engineers from the lab were sent to the plant to aid there. Very accurate grinding of the material was one particular problem, and cooperating wheel producers recommended wheels from their laboratories, which were purchased, tested and evaluated. More than a year was devoted to this project and as a result of the work Westinghouse now recognizes and is prepared to cope with the problems of working this strange metal.

A current project aims at reclaiming the relatively large amount of carbide presently scrapped on most single-point carbide tools. Lab engineers find that about 20 percent of the carbide tip is generally utilized, and the rest scrapped. A technique soon to be announced will substantially increase the usable percentage of material.

Chart shows organization of Engineering department, Headquarters Manufacturing Division.

Metals Joining

The metals joining work generally divides into development and application work much the same as metals forming does. In the development studies the principles of welding under various conditions are studied and the comparative cost and quality of joining by various methods are evaluated. With these principles worked out, the laboratory is in position to quickly evaluate and resolve application problems occurring in the operating divisions.

Facilities of the welding lab include a variety of equipment which enables a comparison between manual and automatic or semiautomatic processes. Arc welding equipment includes all forms of submerged, the inert-gas shielded and metal arc processes, atomic hydrogen and carbon arc. Resistance welding equipment includes from 1 KVA to 1200 KVA capacities, spot, projection, seam, and series types of equipment. Induction heating includes capacities of 1 KW up to 50 KW in both the motor-generator and radio-frequency types. Brazing includes the common gas fuels and the natural

Fig. 4. The auditorium at the Headquarters Manufacturing Engineering Lab building. Manufacturing representatives from the various divisions of the company gather here regularly to learn of new or improved manufacturing methods.

gas-air types. Flame cutting equipment includes means of evaluating all the various gas fuel combinations, plus the means for joint preparations for submerged arc welding development work. Several types of work handling equipment including positioners, variable speed devices, etc., are used to develop the best economic method. Thus, it is evident that the above equipment permits proper evaluation of each method and comparison with other joining methods. Even metal spraying facilities have not been overlooked. The laboratory is also prepared to design and manufacture holding fixtures for adapting laboratory techniques to production applications. To round out the facilities there are mechanical equipment for testing welds and a metallurgical and etching setup for macro- or micro-etch study.

The formulation of welding standards and specifications and the dissemination of information on welding practices are carried on through a metals joining committee. The committee consists of a representative of design engineering and a representative of manufacturing from each division of the company and is steered by a small group selected from these representatives and the metals joining laboratory. Subcommittees to work on specific standards are named from the general committee.

The subcommittee on arc welding, procedures and standards is, for example, composed of arc-welding specialists from those divisions which heavily utilize arc welding.

The committee organization formulates general standards and procedures for the company as a whole and these constitute a framework for the individual specifications and standards set up by each division for its own use.

As equipment involving new principles of operation is developed by the welding machine manufacturers it is bought and studied by the metals joining section to insure that Westinghouse is taking advantage of the best methods known.

The Dividends

The Westinghouse plan proves what a small, well-knit central engineering agency can do when its operation is based on service to and cooperation with a company's manufacturing divisions. Westinghouse operating divisions are independent to the point of substantial differences in thinking, and the success of a side-by-side divisional and headquarters manufacturing engineering organization is a tribute both to the system and to the intelligence of the division and headquarters men behind it.

Fig. 5. The machine lab at the MEL building. Hundreds of experiments are run here each year to determine the best possible machining methods for various materials.

1932 - 1952

Twenty Years of Progress

By O. B. Jones, ASTE Historian
as told to Stuart P. Hall

A technical society that has 100 chapters and 23,000 members does not attain this goal overnight. Preparation for publication of a handbook, THE TOOL ENGINEER magazine, data sheets and reference manuals takes years of planning. Successful industrial expositions, financial aid to education and research, a democratic constitution and by-laws, and ownership of the headquarters building all mean hard work, vision and faith of many individuals in the future of the Society.

The American Society of Tool Engineers has undertaken and accomplished all these objectives. Thus, in its twentieth anniversary year it seems fitting to chart briefly some of the important events that have made possible the attainment of these lofty goals.

Of course, there isn't room to give personal credit to the hundreds of individuals who throughout the years have given so much of their time and financial aid to see the project through. But here's the story as briefly jotted down in diary form by one of the original founders of ASTE.

O. B. JONES

How ASTE Began in 1932

First meeting for organizing a society of tool engineers was held on January 29 at the invitation of O. B. Jones in his office at the Detroit College of Applied Science. By resolution at this meeting the name "Society of Tool Engineers" was adopted. An incorporation committee was appointed and a five-member board of directors created to draw up the first set of bylaws.

Subsequent organization meetings adopted the by-laws, appointed committees, elected officers and created a thirty-three member board of directors.

First formal banquet meeting was held at Hotel Webster Hall on March 23. Officers elected at this meeting include: president, J. A. Siegel; first vice president, W. H. Smila; second vice president, E. J. Ruggles; secretary, A. M. Sargent; treasurer, William Fors.

By March 31 the board of directors was able to pass a resolution closing a charter for 114 members. First technical session was held at a meeting on April 14 at which L. A. Danse, chief metallurgist for Cadillac Motor Car Co., discussed correct design and development of tools and dies for forged connecting rods.

The first official organ of the Society was authorized at an April 21 meeting of the board of directors. Ford R. Lamb, chairman of the publications committee published the first *ASTE Journal* under the date of May, 1932. This first 24-page issue contains news, technical articles and 7½ pages of advertising.

Design for the Society emblem was adopted at the April 28 meeting of the board of directors. As reported by the chairman of the emblem committee, Fred L. Hoffman: "The white letters 'ASTE' placed on the sunburst represent the ideas of the tool engineer bursting forth to improve methods of manufacture, just as the sun throws its light all over the universe. The letters are placed on the bottom without punctuation marks solely to arouse curiosity of people about our new but little known society."

By December 31, membership in the first year climbed to 286. Throughout the year one regular monthly meeting was held in addition to at least two special meetings each month. Beginning a Society of Tool Engineers took time, patience and seemingly endless discussions, the heavy plus load of putting out a monthly technical publication.

In the words of first ASTE president Siegel: "ASTE came into being from the grouped ideas of men who, while possessing aggressiveness and leadership, were imbued with the additional virtue of unselfishness.

How ASTE Grew

. . . . . In 1933*

President: William H. Smila
Membership: 465

New committees were appointed. Recognizing the need for good public relations, the first public relations counsel was appointed in this the second year of growth.

A Speakers Club was formed to give technically trained tool engineers the ability to stand on their feet and put

*Actually the terms of presidency of the ASTE are from March of one year to March of the following year. The year in this history is shown from January 1 to January 1. Thus some of the events recorded under a given president may have actually taken place under the president immediately after him.

their ideas across to those who should hear.

Much effort was put forth this year to combat the idea that ASTE is a union group. Actually a union group that had a similar name and could have embraced tool engineers was in existence and was being actively organized. The Society name was changed to American Society of Tool Engineers and operations of the ASTE were maintained at a strictly professional level to remove the label of "union" that could easily have killed the Society.

In March the national bank holiday tied up ASTE funds (less than $200.00) leaving less that $10.00 cash on hand to operate a group that was publishing a monthly technical journal. The generosity and personal financial efforts of many individuals saved ASTE from ruin.

Initial efforts to form a Flint, Michigan chapter failed, but this did not dampen the spirit or deter membership growth of our infant Society.

. . . . . In 1934

President: T. B. Carpenter
Membership: 307

This was a year of technical meeting growth and development. Excellent meetings helped to get the word around that ASTE is a group of professional men whose sole purpose is the dissemination of "tool engineering know-how".

In the middle of the year the ASTE Journal's strengthening of Society aims and endeavors was evidenced by many encouraging letters received from readers.

Publication of the ASTE Journal was assumed by Bramson Publishing Co. This relieved the membership of a terrific burden and enabled them to devote more effort to growth and strengthening membership. The name of the journal was changed to "The Tool Engineer".

The first data sheets were prepared in accordance with ASTE specifications by the Cincinnati Milling Machine Co.

In this third year the Society progress was well outlined by President Carpenter who said: "We made mistakes along the way, but tried to acknowledge them, pointing out the pitfalls to those who were to follow."

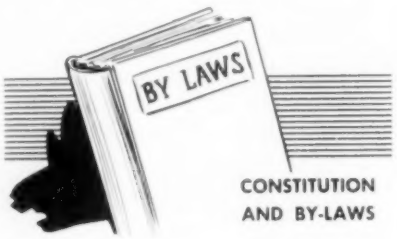
. . . . . In 1935

President: Robert M. Lippard
Chapters Chartered: Racine, Cleveland
Membership: 382

This was a year of learning to serve industry and the membership. The first new chapters were added near the end of the year . . . a milestone in the growth of a society whose success obviously was not to be denied.

ASTE sponsored a meeting of the Machine Tool Congress that was held in conjunction with the National Machine Tool Builders' Association . . . our first recognition from industry. The turning point had now been reached. ASTE was no longer an association of Detroit Tool Engineers. With the chartering of the new Racine and Cleveland chapters, the Detroit chapter took its place as a separate entity in a society whose membership could ultimately embrace several thousand in the profession.

The annual meeting was held in conjunction with the Congress. ASTE had a booth at the show and distributed membership brochures and pamphlets listing Society aims and objectives.



In this administration, efforts were begun to study necessary revisions of the Constitution and By-laws which would offer the membership the best in society practice.

. . . . . In 1936

President: Ford R. Lamb
Chapters Chartered: Milwaukee, Chicago, Fairfield County (rechartered in 1942), and Hartford
Membership: 516

This year the gold letters of ASTE appeared on the Society's own office in the Boulevard Building in Detroit during the month of November. The addition of more chapters and members, of course, pointed the way to more service needs from Society headquarters.

For the first three years of its existence, national headquarters was located in the office of first national secretary, A. M. Sargent. Since 1935 the entire time of one girl had been required to handle Society matters. Now, in 1936 one girl and one man were necessary!

Technical meetings and Speakers' Club activities were changing tool engineers into confident and convincing speakers who aided in furthering the growth and prestige of ASTE.

. . . . . In 193

President: Frank A. Shuler
Chapters Chartered: Pittsburgh, Toledo, Buffalo, Twin Cities, Rockford, Baltimore, Northern New Jersey
Membership: 816

The needs of the ASTE were best met by the constant attention and service of an individual familiar with Society operations and goals from the beginning. When he retired from the presidency, Ford R. Lamb assumed the office of executive secretary of the American Society of Tool Engineers.

Three types of membership were made available to tool engineers in industry: senior, junior and student. ASTE recognized the need for offering Society services to those who would some day become full-fledged tool engineers.

. . . . . In 1938

President: Walter F. Wagner
Chapters Chartered: Philadelphia, Rochester, St. Louis, Dayton, Syracuse, Schenectady, Cincinnati, Central Pennsylvania, Tri-Cities
Membership: 1596

The first ASTE Machine Tool and Progress Exhibition held in Detroit's Convention Hall demonstrated to member and non-member alike the professional ability of the Society. Door-count attendance at the 162-exhibit show was nearly 24,000 persons. And most important, the 1938 exposition was well managed and a financial success.

A national ASTE membership convention was held in conjunction with the 1938 show. Membership in the Society nearly doubled over the previous year. A record number of nine chapters were added. It was no longer difficult to obtain eminent authorities as speakers at ASTE affairs.

A fact-finding committee organized by ASTE and composed of outstanding industrial executives, writers and educators studied the effect of mechanical improvements in industry and labor. On their findings, which were widely published, ASTE president Wagner declared: "Tool Engineers are pioneers on the frontier of economic development."

. . . . . In 1939

President: James R. Weaver
Chapters Chartered: Elmira, Worcester, Toronto, Los Angeles, Golden Gate, Houston, South Bend, Peoria
Membership: 2,750

In this year of continued growth, many national ASTE committees were organized to accomplish further objectives; emphasis was placed by the membership committee on quality rather than quantity of members. They believed that a technical society best served the needs of its membership

n the members met required qualifi-ions in the specified field of en-our.

he newly appointed national edu-tion committee was created to develop an educational program for tool en-neering and to discuss it with colleges and universities throughout the country. Although the initial efforts met with a discouraging reception, the committee continued its work.

A second show, the 1939 Machine and Tool Progress Exposition was held in the Detroit Convention Hall. Like the initial effort, this show was highly successful. Over 35,000 (door-count) attended the exhibition and saw 250 exhibits.

Technical papers presented before both national meetings and chapter meetings highlighted ASTE efforts.

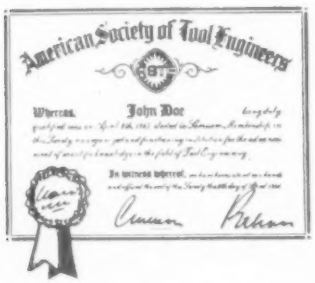
. . . . . In 1940

President: A. H. d'Arcambal

Chapters Chartered: Springfield, Boston, Greater New York, Binghamton, Columbus, Indianapolis, Western Michigan

Membership: 3,947

This was a year of individual chapter growth. Membership expanded by nearly 50 percent during the year.



By this time the Society had begun to assume its rightful place as one of the recognized professional societies in the nation. Much of this was due to the personal prestige of the president who visited many of the chapters during the year to deliver technical addresses on a wide variety of subjects. The annual meeting was held in New York and for the first time, ladies' activities were a feature of the program.

. . . . . In 1941

President: Frank W. Curtis

Chapters Chartered: Seattle, Twin States, New Haven, Hamilton, Nashville, San Diego, Fond du Lac, Portland, Akron

Membership: 5,670

ASTE executive secretary Ford Lamb passed away. The national officers carried on until Adrian Potter was appointed to the position. Another record number of chapters were added this year. Each year ASTE seemed to grow in prestige and numbers.

Again emphasis was placed on the importance of good technical programs to build meetings and membership. In the words of President Curtis: "Good meetings are the backbone of a chapter. Nothing should be spared in their preparation and execution."

With the advent of the tooling program for World War II began the awakening of the nation and the entire world to the things the tool engineer knows best—the mass production of goods.

The third ASTE Machine Tool and Progress Exposition was held in Detroit's Convention Hall. More than 250 exhibits attracted 40,000 (door-count). Now an ASTE exposition is no longer a novelty. ASTE has demonstrated its ability to create good industrial expositions. Even though engaged in their biggest program in history, tool engineers and executives attended these expositions without question.

. . . . . In 1942

President: Otto W. Winter

Chapters Chartered: Potomac, Williamsport, Montreal, North Texas, Wichita, Little Rhody, Louisville, Windsor

Membership: 8,708

The world's biggest tooling program put the tool engineers in America to test. In many chapter cities the ASTE Tool Engineering Talent Survey named persons who helped staff war production advisory councils that assisted war plants making products unfamiliar to their type of manufacture.

Many ASTE members taught in the Engineer-Science-Management War Training program of the government. Interest in tool engineering production know-how was unprecedented. Meeting attendance set a new high. ASTE helped publish and distribute war training material—particularly the New York State Education department monographs.

The groundwork of the education committee continued during the war on the long term program of installing tool engineering courses in colleges and universities.

. . . . . In 1943

President: Ray H. Morris

Chapters Chartered: Fort Wayne, Kansas City, Decatur, Lakehead (now dormant), New Orleans, Atlanta, Erie

Membership: 11,898

This was a year of tremendous membership growth and the ASTE initiated the project of publishing a handbook for tool engineers. An initial appropriation of $5,000 was voted by the ASTE board of directors for this project.

Growing pains were experienced by the ASTE in view of growth during a war year. The 11th annual meeting was held in conjunction with a regional War Production Machine and Tool Progress Exhibition in Milwaukee's Mechanics' Hall. More than 10,000 saw 138 exhibits. A series of six technical sessions attracted about 500 tool engineers per session.

The Constitution and By-Laws had been so frequently amended that national officials had trouble determining and initiating clear-cut programs. An organization progress committee was created to revamp the Constitution and By-Laws.

. . . . . In 1944

President: D. D. Burnside

Chapters Chartered: Portland (Ore.), Springfield (Ill.), Niagara District, Richmond

Membership: 15,128

There were more growing pains and membership shot up another 3,000 this year. The ASTE West Coast Conference and Exhibit in the Baltimore Hotel in Los Angeles drew 855 people to technical sessions and an equipment exhibit by 28 industrial firms.

. . . . . In 1945

President: C. V. Briner

Chapters Chartered: Phoenix, Saginaw Valley, Pontiac, Muncie, Cedar Rapids, Fox River Valley

Membership: 17,198

This year marked a milestone in ASTE history. The new Constitution and By-Laws were adopted, making what is said to be one of the most democratic organizations among technical societies.

The Society changed publishers for THE TOOL ENGINEER magazine, awarding the contract to R. E. Powers. The February issue in 1945 was the first published under the new agreement.

An editor for the Tool Engineers Handbook was appointed in July, making this project a reality.

A complete reorganization of headquarters accounting procedures helped to build closer cooperation between chapters and national headquarters.

H. E. Conrad was named executive secretary.

. . . . . In 1946

President: A. M. Sargent
Chapters Chartered: Evansville, Mid-Hudson, Madison
Membership: 16,712

ASTE, on a sound financial basis, enjoyed most successful exposition in its history in the Cleveland Public Auditorium. More than 15,000 registered and 53,000 (door-count) visited the 350 exhibits devoted to tool engineering. Technical sessions at the annual convention drew record crowds.

Further efforts were made by national officers to integrate the chapters and their committees into those of the national organization. Close harmony between chapters and headquarters was achieved.

A second major effort of this year was the establishment of means of distributing information regarding all the activities of the Society to officers, directors, national committees and all the channels of the chapters.

. . . . . In 1947

President: William B. Peirce
Chapters Added: Springfield (O.), Denver
Membership: 16,970

Further work helped to integrate operations according to the new Constitution and By-Laws. THE TOOL ENGINEER continued to improve as a Society organ.

There were thoughts about a new headquarters building in a suburban area. Needs of the Society were expanding daily. Some members talked of a 25,000 membership goal. President Peirce personally visited 40 chapters.

. . . . . In 1948

President: Irwin F. Holland
Membership: 16,894

The new ASTE headquarters building at 10700 Puritan Avenue was begun and completed, during the year, and was financed partially by bond issue to membership.

A huge exposition was held in Cleveland Public Auditorium with 326 exhibits and a registered attendance of 16,416. Final manuscript for the *Tool Engineers Handbook* was delivered to the printer. Semi-annual meeting of Society was held in Los Angeles.

. . . . . In 1949

President: R. B. Douglas
Chapters Chartered: Mohawk Valley, Waterloo Area, Des Moines, Grand River Valley, Piedmont
Membership: 16,942

International aspects of ASTE were demonstrated this year by election of a president from Canada. The biggest event in ASTE history occurred with the publication of the *Tool Engineers Handbook*.

The Society took over the complete publication of THE TOOL ENGINEER in an effort to provide the membership the best in a technical publication. All the building bonds bought by the members were retired.

. . . . . In 1950

President: H. L. Tigges
Chapters Chartered: Lehigh Valley, Long Beach, Salt Lake City, Granite State
Membership: 17,256

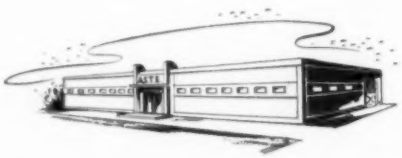
More growth and more visions of the future by the board of directors. Another tremendously successful exposition was held in Philadelphia. 18,000 registered to see 335 exhibits.

An idea that alone may well put ASTE indelibly on the pages of industrial history was put into effect by the appropriation of funds for a research foundation. In this connection, it is interesting to reminisce. Only 18 years ago, the Society had $10.00 and a handful of members. Now it visions what it can accomplish in the way of industrial research initiated with its own funds.

. . . . . In 1951

President: J. J. Demuth
Chapters Chartered: Jackson, Long Island, Lancaster, Tulsa, London-St. Thomas, Los Alamos, Albuquerque, Petersborough
Membership: 18,181

Just look at the number of chapters added this year. Where did all that enthusiasm come from? Of course the Korean War was making even greater need for tool engineers than during the peak of World War II. Tooling for Security meant more and better tool engineers.



Work on the *Die Manual* was begun as a companion piece to the *Handbook*. The first degree in tool engineering was offered this year at Utah State University. This year, ASTE offered its first university scholarships. They went to four students in the U.S. and to one in Canada. This plan to aid students following tool engineering careers tied up well with an industrial research program.

ASTE President Demuth joined past president H. L. Tigges among the Washington key war production men.

. . . . . In 1952

President: L. B. Bellamy
Chapters Chartered: San Gabriel Valley, LaCrosse, Lima, Santa Clara Valley, San Fernando Valley, North Massachusetts
Membership: 23,000 (as of Sept. 1)

What a fitting year. Chapters now number 100. When they talk about the accomplishments of the ASTE in 1952, they will have a lot to talk about. Just about everything that those founders envisioned back in 1932 has been accomplished. It is something they started, hundreds pushed and thousands completed and it took only twenty years. Look at the record:

1. Chicago—the biggest and best ASTE Industrial Exposition in history—400 exhibitors, 40,000 registered attendance, 48 technical papers, radio and TV recognition, crowds and yes, a successful show.
2. Procurement of five $10,000 bonds to finance further university scholarships.

3. Heads of industrial research organizations consult with ASTE officials on the ASTE Research Fund that gets closer to reality every day.
4. And that recognition for which those first self-chosen few tried. One point should suffice. Last month they had a symposium on tools in connection with the 1952 Centennial of Engineering in Chicago. Six men spoke including President Bellamy, five of whom were ASTE members.

The Future

The future for ASTE holds whatever its members, its officers and its board of directors dare to invision. The founders had that vision—their goals have been far exceeded. But it remains for all of the membership today to keep and promote the utility of a technical society that this year reaches a significant milestone.

1932-33
Joseph A. Seigel*

1933-34
William H. Smita

1934-35
T. Bert Carpenter

1935-36
Robert M. Lippard*

1936-37
Ford R. Lamb*

1937-38
Frank A. Shuler

1938-39
Walter F. Wagner

1939-40
James R. Weaver

1940-41
A. H. d'Arcambal

Past Presidents 1932 - 1952

*Deceased

1941-42
Frank W. Curtis

1942-43
O. W. Winter

1943-44
Ray H. Morris

1944-45
Douglas D. Burnside

ASTE Purpose:

"To be an organized and functioning institution for the advancement of scientific knowledge in the field of Tool Engineering and the means and methods of applying such knowledge in practice and education in such knowledge and practice; and within said field and to such end, and none other, to promote and through its members engage in research, writing, publishing and dissemination of such knowledge and if there should be any net earnings from any activities aforesaid, the same shall accrue solely to said institution and no part thereof shall inure to any member or individual."

1945-46
Cletus V. Briner

1946-47
Albert M. Sargent

1947-48
W. B. Peirce

1948-49
I. F. Holland

1949-50
Robert B. Douglas

1950-51
H. L. Tigges

1951-52
J. J. Demuth

NATIONAL OFFICERS and

President
Leslie B. Bellamy
1951-52-53 Board Member

First Vice President
Roger F. Waindle
1952-53 Board Member

Second Vice President
Joseph P. Crosby
1951-52 Board Member

Third Vice President
Harry B. Osborn, Jr.
1951-52-53 Board Member

Secretary
Harold E. Collins
1951-52 Board Member

Treasurer
Howard C. McMillen

Assistant Secretary-Treasurer
Gerald A. Rogers
1952-53 Board Member

BOARD of DIRECTORS

J. J. Demuth
1951-52-53

Edward W. Ernst
1951-52

T. J. Donovan, Jr.
1951-52-53

Ben J. Hazewinkel
1951-52-53

George A. Goodwin
1951-52-53

W. B. McClellan
1951-52-53

Fred J. Schmitt
1952-53

Willis G. Ehrhardt
1952-53

ASTE National Committees

Membership

A. B. Clark, Chairman
Cleveland, O.

The chief responsibility of the National Membership Committee concerns stimulating member interest in the Society and increasing membership in ASTE.

Area Captains

Thomas C. Bradford
Worcester, Mass.
Dale H. Burke
Toledo, O.
Irving H. Buck
Dallas, Tex.
Wayne Ewing
Los Angeles, Calif.
Warren L. Foss
Denver, Colo.
Erwin Huchzermeier
St. Louis, Mo.
Emil Kitzman
Lansdale, Pa.
Robert W. Miller
Cincinnati, O.
Oliver J. Onken
Bensenville, Ill.
G. A. Rogers
Montreal, Que.
Harry H. Whitehall
Galt, Ont.
William W. Schug
Hudson, N.Y.

Area Lieutenants

Charles H. Briggs
DeWitt, N.Y.
Robert L. Gay
Manchester, Conn.
F. J. Goeffroy
Denver, Colo.
W. H. Gourlie
West Hartford, Conn.
Herbert D. Groth
Lake Wood, O.
Carl Kertesz
Jamaica, N.Y.
H. V. Loeppert
Skokie, Ill.
E. H. Porter
Indianapolis, Ind.
W. G. Shaw
Detroit, Mich.
Louis Slager
Kirkwood, Mo.
John N. Stansbury
Long Beach, Calif.

Professional Engineering

C. M. Smillie, Chairman
Detroit, Mich.

Primary responsibility of the National Professional Engineering Committee is to further the interest of the tool engineer in connection with his professional endeavor and his professional standing as a registered engineer.

Hugo L. Aglietti
Woodside, N. Y.
Prof. L. E. Doyle
Urbana, Ill.
V. H. Gallichotte
Palo Alto, Calif.
H. G. Heimann
Milwaukee, Wis.
J. D. Schiller
Winston-Salem, N. C.
L. C. Seager
Salt Lake City, Utah
L. G. Singer
Toronto, Ont.

Honor Awards and Judicial Committees

W. H. Smila, Chairman
Detroit, Mich.

The nine living past presidents with the earliest tenure of office in the Society serve on these two national committees. They determine final disposition on judicial matters referred by the Board of Directors or member petition and also select winners of ASTE honor awards.

T. Bert Carpenter
Birmingham, Mich.
Frank A. Shuler
Detroit, Mich.
Walter F. Wagner
Detroit, Mich.
James R. Weaver
Drexel Hill, Pa.
A. H. d'Arcambal
West Hartford, Conn.
Frank W. Curtis
Detroit, Mich.
O. W. Winter
Grand Island, N. Y.
Ray H. Morris
North Canton, Conn.

Editorial

Wayne Kay, Chairman
Detroit, Mich.

General policies of THE TOOL ENGINEER magazine are reviewed and set by National Editorial Committee members.

L. W. Greenblatt, Jr.
St. Louis, Mo.
Joseph L. Petz
Poughkeepsie, N.Y.
Gordon Swardenski
Peoria, Ill.
Ronald W. Updike
Indianapolis, Ind.

Standards

R. C. W. Peterson, Chairman
Toledo, O.

Members of the National Standards Committee investigate and report on subjects of interest to ASTE. Working closely with standards groups in other organizations, they revise or recommend practices in the field of tool engineering. Publishing and distributing data sheets is an important part of their work.

Joseph C. Brenner
Nassau County, N.Y.
Owen E. Harvey
Cleveland, O.
Grant S. Wilcox, Jr.
Grosse Pointe Farms, Mich.
William Moreland
Rockford, Ill.
George F. Bryan
Pontiac, Mich.
Francis J. Sehn
Detroit, Mich.

Finance

W. F. Jarvis, Chairman
Portland, Conn.

Members of the National Finance Committee prepare the annual budget covering the operations of the Society for presentation at the semi-annual meeting and make recommendations to the Board of Directors concerning investments.

H. Dale Long
Western Springs, Ill.
Howard C. McMillen
Bedford, Ind.
Milburn Ross
Wichita, Kan.
Daniel Wesson
Monson, Mass.

Participants in a meeting of the National Membership Committee (seated, from left) are: Wayne Ewing; Marvin Bunting of the headquarters staff; O. J. Onken; Dr. H. B. Osborn, Jr., third vice-president; A. B. Clark, membership chairman; Harry E. Conrad, ASTE executive secretary; H. E. Collins, national secretary; and Emil Kitzman. Standing: Dale H. Burke; F. J. Geoffroy; G. A. Rogers, assistant secretary-treasurer; and W. W. Schug.

Pictured at a meeting of research directors of several universities and leading research laboratories and officials of the Society (seated, from left) are: H. F. Poehle, assistant to director, Engineering Research Institute, University of Michigan; Prof. O. W. Boston, chairman, department of production engineering, University of Michigan; L. B. Bellamy, ASTE president; Prof. J. N. Edmondson, industrial engineering dept., Ohio State University; William Brown, supervisor, Battelle Memorial Institute; Dr. J. S. Owens, research dept., Champion Spark Plug Co.; and Dr. Paul Pepper, research coordinator, Ohio State University. Standing: H. E. Conrad, ASTE executive secretary; A. F. Denham, ASTE public relations counsel; Dr. W. E. Mahin, research director, Armour Research Foundation; F. W. Wilson, ASTE technical director, and M. F. Bunting, ASTE headquarters staff.

Members of ASTE's National Professional Engineering Committee shown here are: (seated, from left) V. H. Gallichotte, President L. B. Bellamy, Chairman Charles M. Smillie and Second Vice President J. P. Crosby. Standing: A. F. Moosbrugger (resigned), Executive Secretary Harry E. Conrad, Prof L. E. Doyle, H. L. Aglietti and Marvin Bunting, Headquarters staff.

Program

J. O. Horne, Chairman
Rochester, N. Y.

In addition to staging all membership meeting programs, the National Program Committee maintains a Speakers and Films Directory for use by the chapter program chairmen.

Thomas C. Barber
Chicago, Ill.
Monta O. Cox
Detroit, Mich.
Clinton J. Helton
Denver, Colo.
Kenneth W. Riddle
Moylan, Pa.

Constitution and By-Laws

E. H. Ruder, Chairman
Richmond Heights, Mo.

All matters concerning the constitution and by-laws of the Society are reviewed by this committee so that ASTE operations and activities may be properly executed.

Edward J. Berry, Vice Chairman
Providence, R. I.
Harry Z. Marx
Dearborn, Mich.
John X. Ryneska
Lynn, Mass.
J. J. Demuth
St. Louis, Mo.

Public Relations

L. F. Hawes, Chairman
Downey, Calif.

The National Public Relations Committee is responsible for increasing public and industrial understanding of tool engineering and activities of the Society.

Charles O. Herb
Summit, N.J.
R. Eric Crawford
Toronto, Ont.
W. G. Patton
Detroit, Mich.
H. E. Linsley
Hawthorne, N.J.

Book

F. J. Sehn, Chairman
Detroit, Mich.

Members of the National Book Committee have full responsibility for policy, planning and administration of all technical bound books published by ASTE.

Morris M. Clemons
Cleveland, O.
N. L. Kenerson
Detroit, Mich.
W. J. Potthoff
Creve Coeur, Mo.
Edward A. Reed
Flint, Mich.
Ralph F. Weil
Waterford, Mich.
R. J. Wilcox
Lansing, Mich.

ASTE Tool Engineering Research Fund

Prof. J. N. Edmondson, Chairman
Columbus, O.

This temporary committee recommends to the Board of Directors organizational procedure necessary for the ground work of ASTE research activity.

P. C. Wood
Toledo, O.
Prof. Orlan W. Boston
Ann Arbor, Mich.

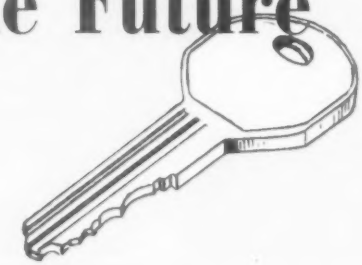
Education

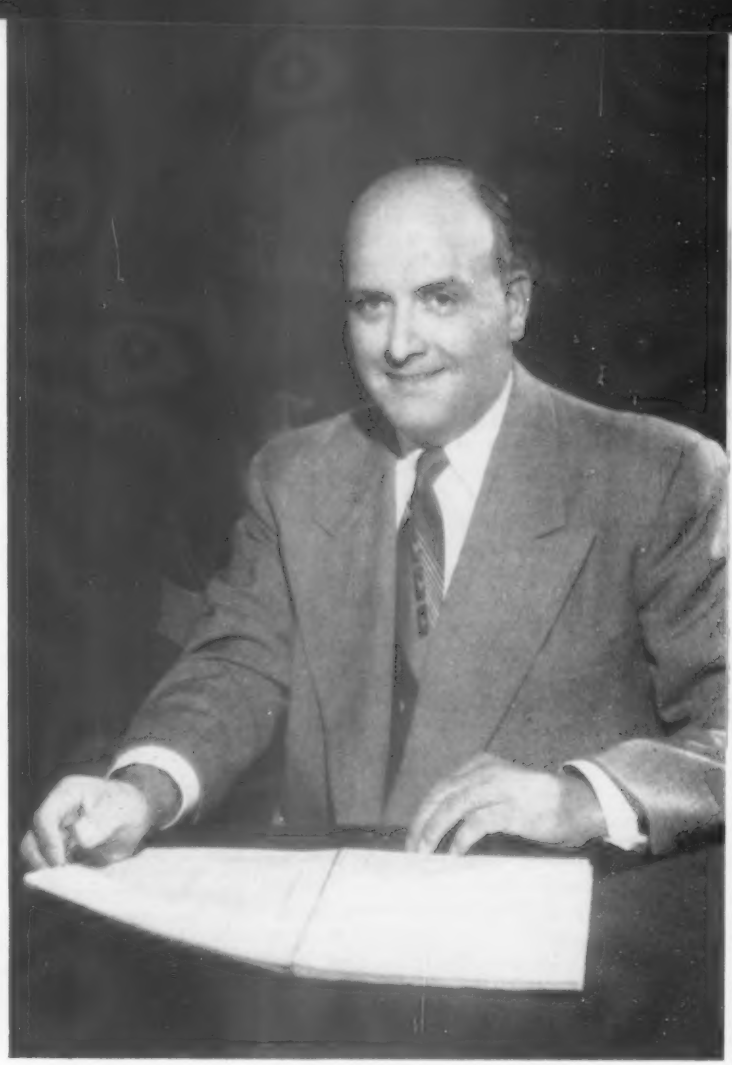
A. R. Diamond, Chairman
Philadelphia, Pa.

The National Education Committee aids colleges, universities and secondary schools in forming curricula and extension courses to help increase facilities for tool engineering education. Members select winners of National ASTE scholarships.

Prof. M. L. Begeman
Austin, Texas
Prof. J. N. Edmondson
Columbus, O.
Prof. W. W. Gilbert
Ann Arbor, Mich.
Prof. Frederick Preator
Logan, Utah
C. Douglas Wright
Oshawa, Ont.

TOOL ENGINEERING: Our Key to the Future





By L. B. Bellamy
PRESIDENT
AMERICAN SOCIETY OF TOOL ENGINEERS

Tools have been aptly defined as "anything that will multiply the effectiveness of man's efforts." A tractor is a tool. A factory is a tool. So is a lathe, a drill, or a gage. The United States has led the rest of the world in the scientific creation and application of ever better tooling, making it possible to achieve the highest standard of living the world has ever known.

More than this, tools have made it possible for man to enjoy the fruits of their creation and utilization. Future history will show that if a free man has the opportunity to obtain his material needs through less effort and less time, he eventually will learn how to use his leisure time in improving himself, socially, culturally and spiritually. In providing this opportunity, tools are giving man a new freedom—the freedom to develop as an individual.

Social Considerations

It is true that tool engineers are devoted ostensibly to the furtherance of a highly mechanistic art or science. Yet not even in so technical a project as the design of a new machine tool, can social considerations be forgotten.

New tooling must not be put into effect at the expense of the man who uses those tools. Safety is a constant consideration. Efficiency must always be kept in mind so the machine will require as little physical effort to operate as possible. Such concerns are so routine that their social implications easily slip from view.

Tool engineering is, of course, an ancient art. Anyone who created or applied any kind of a new or better tool since the world began has been, in a manner of speaking, a tool engineer. That goes pretty far back—back to the stone club, the spear and the flint.

Why has it been, then, that until recently the tool engineer went unrecognized, with not even a technical society of his own? The answer lies in the tardiness to recognize the actual importance of tools in themselves. Realization that the scientific development and application of tooling embodied a distinct profession dates back only to the advent of mass production. Mass production has been defined in many ways. Some call it "production of interchangeable parts." Others refer to it as the manufacture of identical products on a large scale. Both of these definitions are true in their way, but they leave out the one essential element.

Production for the Masses

Mass production is inherently "production for the masses." Interchangeability of parts, similarity of all finished products of the same type, are merely the means to the end. Without that interchangeability and standardization of assembly, production for the masses would be impossible from any economic consideration. Without production for the masses, interchangeability and standardization would be relatively meaningless.

Since the earliest days of history, the greatest progress in tooling has almost always taken place as the result of developments concerned with war and the tools of war. One hundred years ago, one of the country's tool engineers and a man who did as much as anyone to point the way to our present standard

This address was delivered Sept. 5 at the Centennial of Engineering in Chicago.

of living, did so while engaged in the manufacture of weapons of destruction.

That early tool engineer was Eli Whitney. He was far more than the inventor of the cotton gin. Given an order to build some muskets, Whitney was slow in making deliveries, not an unusual occurrence in any defense program. Hauled on the carpet by the NPA of that time, Whitney explained that he was not content with the current practice of making muskets by hand. At that time, highly skilled workers made each part in turn and then matched various parts together until a musket was completed.

Whitney had conceived the idea of making all similar parts for all muskets exactly alike and interchangeable. In this way, he could eliminate laborious hand fitting. He could employ relatively unskilled labor instead of having to depend on craftsmen. With this approach he felt it would be possible to use machines to turn out muskets in enormous quantities instead of just one at a time.

Changes in Our Way of Living

It was not until well into this century that the basic concepts of mass production and tool engineering became fairly generally accepted. Tool engineering changed the automobile from a rich man's plaything to something everyone could own and use. Tool engineering created the processes, the machines and other tooling by which each part of the automobile could be produced by the thousands and millions, each one at low cost, and each one exactly like the other.

It was the tool engineer who conceived and created the idea of assembly lines where all the different parts came together, to be assembled quickly without trouble or fitting. What tool engineering and tool engineers did for the automobile, they did for practically every other of today's mass production industries—television and radio receivers; electric lights and chemicals; bath tubs and plumbing ware; stoves and washing machines; cameras and motion picture equipment; golf clubs, fishing rods and reels; bowling pins, balls and alleys; eye glasses, clothing and shoes —practically everything the mass ownership of which we take for granted today.

He created machines that require practically no skill to operate. He thus has made it possible for the untrained factory worker to earn wages far beyond those of the most highly trained and skilled artisan of bygone days.

Certainly every one of these items could have been produced without the application of tool engineering. But the quantities would have had to be so small that the cost of each would have been far out of the reach of the average citizen. Without tool engineering, wealth, leisure and the freedom to develop socially and every other way would have remained largely the privilege of the so-called chosen few.

Specialized Professions

One of the outstanding characteristics of every civilization has been the birth and development of specialized professions to meet the specific needs of that civilization. Our modern technological civilization is no exception. Tool engineering of course is not the only new profession to which it has given birth. Mechanical and electrical enigneers, metallurgical and chemical engineers, civil engineers, radio and television engineers—each of these groups represents a well-defined and well-established profession today. This was not true in their early days.

Rarely is a new profession recognized or identified at or near the time of its birth. Sometimes centuries elapse before a profession reaches a sufficient degree of maturity to achieve general recognition. As a matter of fact, even the members of a new profession rarely regard themselves as professional men. They tend to think of themselves as technicians—craftsmen—with perhaps a rather specialized knowledge or skill.

This condition continues until some event sheds light on the professional character of the group. Before that event occurs, however, a few individuals in the group will have begun to suspect that they were actually pursuing a profession rather than a craft.

They look around and discover that there are dozens, hundreds, perhaps thousands of other individuals engaged in similar professional work. They recognize that these others, like themselves, are using their brains rather than their hands in their daily work. It is this—using your head more than your hands —which is the mark of a professional man. A feeling of kinship develops between these men. They meet occasionally and exchange experiences and know-how. Gradually, more individuals join the group. Suddenly the group realizes that it has followed an historical pattern and has laid the cornerstone of a new professional society.

Greatest Use of Tools

Young as the American Society of Tool Engineers still is, it represents a profession which, more than any other, sets our own civilization apart from all previous civilizations. Never before has any civilization made so great a use of tools—factories; machines; conveyors; hydraulic, mechanical and electrical devices; cutting tools; jigs and fixtures; and the like.

Never before has any civilization achieved so great and free a collaboration between tool engineers in the plants of machine manufacturers, of tool manufacturers and of machine and tool users.

Our future welfare and security is dependent on our continued ability to use tools to produce these things and other things faster, better and with less physical effort—not on how many bath tubs, automobiles, telephones, radios and television sets we now have. It took a long time to learn this simple fact. It took a long time for the simple reason that the profession of tool engineering followed the pattern of all other professions.

Since the early tool engineers considered themselves craftsmen, they were so busy doing, thinking and originating that they did not even stop to evaluate their own vital position in modern society. Even a top-flight tool engineer was and frequently still is called a "master mechanic."

Since tool engineering has only recently become a recognized profession, colleges provided no courses designed to develop and train such engineers. Neither did secondary schools have much to offer in preparing a young man for this specialized field. No engineering society concerned itself to any extent with men whose interests lay in the techniques of and equipment for production.

It's been only 20 years since a few individual tool engineers began to recognize the wide gulf between their own occupation and that of craftsmen and founded the long overdue American Society of Tool Engineers. The growth of ASTE, which followed the awakening of the professional concept, was spectacular and spontaneous.

Future Responsibilities

Today's and tomorrow's engineer must look far beyond his normal horizons. He must and he is beginning to take an active interest in things which rarely concerned him before. The day when engineers were wedded to their slide rules and handbooks is over.

In the future more and more engineers will be leaders of businesses of all kinds. More and more engineers will be serving in local, state and federal governments. More and more engineers will be actively contributing and supporting the development of the arts and culture of the nation.

This is essential. If our civilization is based on engineering, then engineers inevitably must take upon themselves a major part of the responsibility for guiding the destinies of that civilization.

Directory of ASTE Chapter Chairmen

AKRON
Allison Orvis Hunt
Medina, O.

ALBUQUERQUE
Jerome F. Durrie
Albuquerque, N. M.

ATLANTA
Frank Frost Ford
Atlanta, Ga.

BALTIMORE
Leon E. Laux
Towson, Md.

BINGHAMTON
William A. Leindecker
Johnson City, N. Y.

BOSTON
Harold L. Seekins
Marblehead, Mass.

BUFFALO-NIAGARA
William L. Clarke
Buffalo, N. Y.

CEDAR RAPIDS
Edwin Klouda
Cedar Rapids, Iowa

CENTRAL PENNSYLVANIA
Burnell C. Stambaugh
Hanover, Pa.

CHICAGO
H. Verne Loeppert
Skokie, Ill.

CINCINNATI
Joseph Aprile
Cincinnati, O.

CLEVELAND
A. B. Clark
Cleveland, O.

COLUMBUS
Jack E. Mitchell
Columbus, O.

DAYTON
Richard M. Blair
Dayton, O.

DECATUR
Fred W. Sobottka
Decatur, Ill.

DENVER
F. J. Geoffroy
Denver, Colo.

DES MOINES
Howard E. Campbell
Des Moines, Iowa

DETROIT
Edward D. Wiard
Detroit, Mich.

ELMIRA
Raymond F. Banfield
Horsehead, N. Y.

ERIE
Walter S. Cebelinski
Erie, Pa.

EVANSVILLE
Henry J. Pernicka
Evansville, Ind.

FAIRFIELD COUNTY
Mason B. Whiting
Redding Ridge, Conn.

FOND DU LAC
Paul V. Rohling
Sheboygan, Wis.

FORT WAYNE
Everett R. Keese
Fort Wayne, Ind.

FOX RIVER VALLEY
George R. Parsons
Elgin, Ill.

GOLDEN GATE
Ted J. Rohrer
San Francisco, Calif.

GRAND RIVER VALLEY
David E. McCready
Guelph, Ont., Canada

GRANITE STATE
James David Wilson
Andover, Mass.

HAMILTON
William McKee Shaw
Guelph, Ont., Canada

HARTFORD
Henry E. Kuryla
Milford, Conn.

HOUSTON
George L. Freeman
Houston, Texas

INDIANAPOLIS
Denis F. White
Indianapolis, Ind.

JACKSON
Edwin G. Small
Jackson, Mich.

KANSAS CITY
John W. Hoover
Kansas City, Mo.

LA CROSSE
John David Holly
La Crosse, Wis.

LANCASTER, GREATER
Willis M. Houck
New Holland, Pa.

LEHIGH VALLEY
John Eaton
Allentown, Pa.

LIMA
R. J. Schimpf
Lima, O.

LITTLE RHODY
Matthew J. Grochmal
North Dartmouth, Mass.

LONDON-ST. THOMAS & DIST.
Albert H. Ward
London, Ont., Canada

LONG BEACH
Frank D. Wallace
Long Beach, Calif.

LONG ISLAND
William W. Rogers
Farmingdale, L. I., N. Y.

LOS ALAMOS
Norman C. Blezek
Los Alamos, N. M.

LOS ANGELES
Ralph Louis Chrissie
Los Angeles, Calif.

LOUISVILLE
Robert F. Stucker
Louisville, Ky.

MADISON
Charles W. Neff
Madison, Wis.

MID-HUDSON
Joseph A. Crane
Poughkeepsie, N. Y.

MILWAUKEE
Waldemar E. Klein
Milwaukee, Wis.

MOHAWK VALLEY
Albert Charles Delmont
Utica, N. Y.

MONTREAL
Creighton Joseph McDowell
Montreal, Quebec, Canada

MUNCIE
Lake Lavon Deane
Muncie, Ind.

NASHVILLE
John W. Gipson
Nashville, Tenn.

NEW HAVEN
John H. Alton
New Haven, Conn.

NEW ORLEANS
James R. Cypher
New Orleans, La.

NEW YORK, GREATER
Eugene Roth
New York, N. Y.

NIAGARA DISTRICT
John Michael Marchyn
St. Catharines, Ont., Canada

NORTH TEXAS
Arnold E. Unruh
Fort Worth, Texas

NORTH NEW JERSEY
Clyde C. Shannon
Union, N. J.

PEORIA
William H. Logue
E. Peoria, Ill.

PETERBOROUGH
Robert R. Dyer
Peterborough, Ont., Canada

PHILADELPHIA
Albert B. Luecke
Cheltenham, Pa.

PIEDMONT
Charles J. Rix
Winston-Salem, N. C.

PITTSBURGH
Fred Hennig, Jr.
Pittsburgh, Pa.

PONTIAC
Ronald J. Hayward
Pontiac, Mich.

PORTLAND, ME.
John J. Green
Portland, Me.

PORTLAND, ORE.
Daniel J. Melody
Portland, Ore.

POTOMAC
William E. Jones
Washington, D. C.

RACINE
John George Obermeyer
Racine, Wis.

RICHMOND
James C. Brindell
Richmond, Ind.

ROCHESTER
Charles L. DeMartin
Rochester, N. Y.

ROCKFORD
Bruce H. Lundgren
Rockford, Ill.

SAGINAW VALLEY
Clyde L. Fanning
Flint, Mich.

ST. LOUIS
Erwin Paul Huchzermeier
St. Louis, Ma.

SALT LAKE CITY
John F. Woodhead
Salt Lake City, Utah

SAN DIEGO
Arthur E. Crom
San Diego, Calif.

SAN FERNANDO VALLEY
Arthur D. Lewis
Glendale, Calif.

SAN GABRIEL VALLEY
Edward A. Smith
Monrovia, Calif.

SANTA CLARA VALLEY
Vincent E. Diehl
San Francisco, Calif.

SCHENECTADY
A. Edmund Lee
Scotia, N. Y.

SEATTLE
A. J. Gembolis
Seattle, Wash.

SOUTH BEND
Lawrence Haverstock
South Bend, Ind.

SPRINGFIELD, ILL.
Robert C. Peek
Springfield, Ill.

SPRINGFIELD, MASS.
William F. Buckley
Springfield, Mass.

SPRINGFIELD, O.
Kenneth A. Forsell
Springfield, O.

SYRACUSE
Albert C. Vesper
Syracuse, N. Y.

TOLEDO
Elmer L. Faber
Toledo, O.

TORONTO
Fred J. E. Lockhart
Toronto, Ont., Canada

TRI-CITIES
Gilbert H. Jording
Rock Island, Ill.

TULSA
John H. Keyes
Tulsa, Okla.

TWIN CITIES
Don Reiner
Minneapolis, Minn.

TWIN STATES
Robert William Lafflin
Springfield, Vt.

WATERLOO AREA
David D. Lowber
Ann Arbor, Mich.

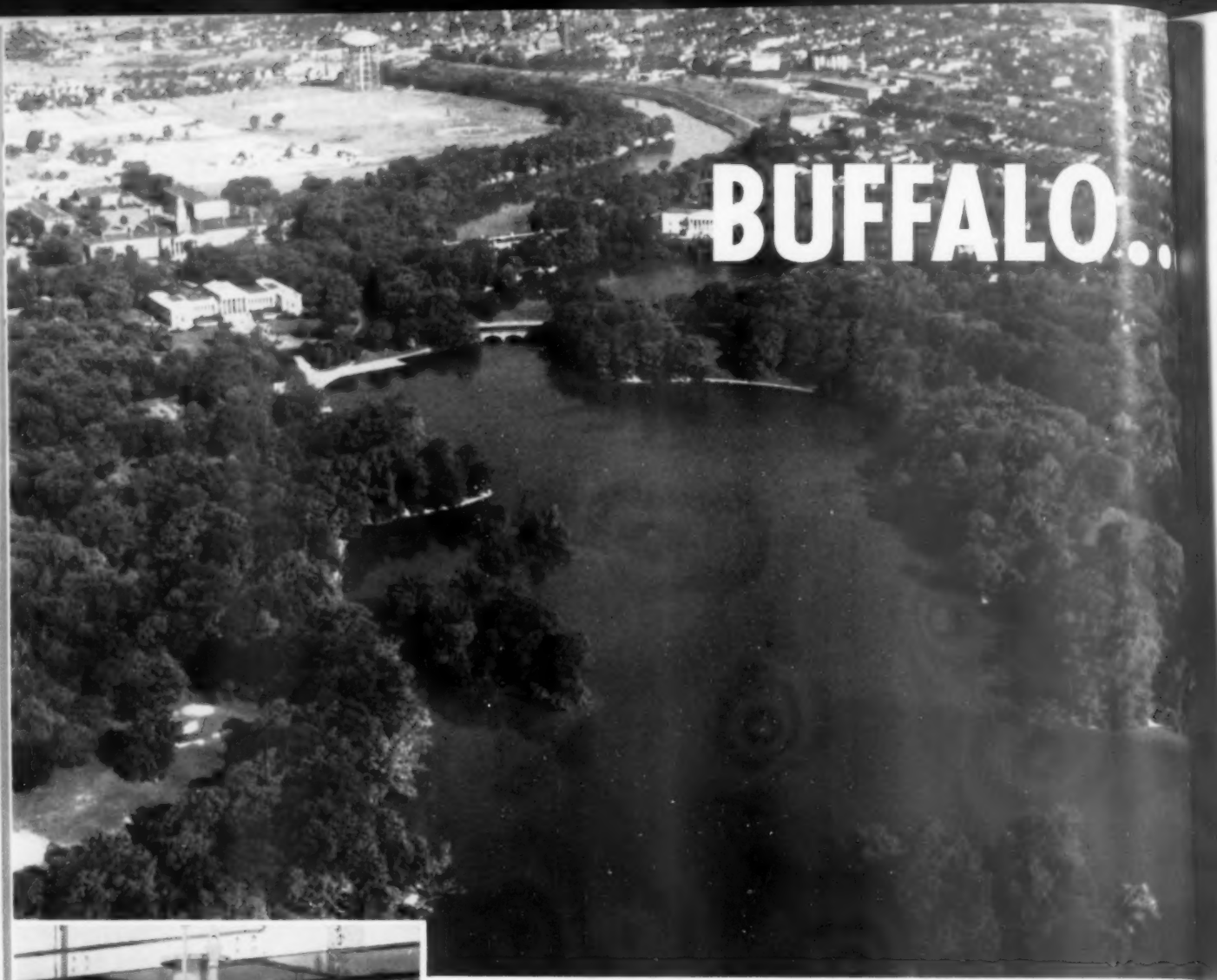
WESTERN MICHIGAN
Robert J. Maguire
Grand Rapids, Mich.

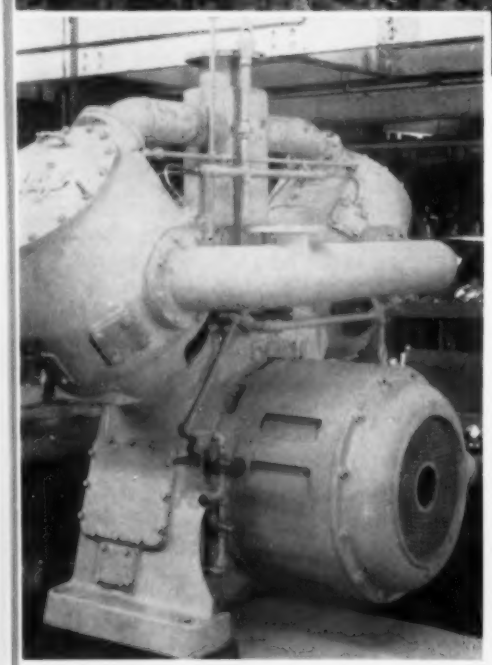
WICHITA
Orville B. Strahm
Wichita, Kans.

WILLIAMSPORT
Morris C. Smith
Montoursville, Pa.

WINDSOR
David C. Heath
Windsor, Ont., Canada

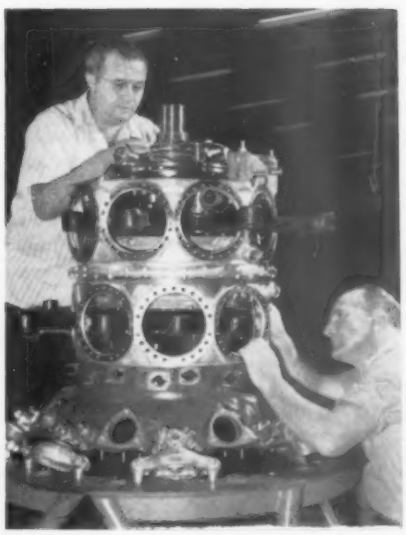
WORCESTER
E. Roland Ljungquist
Worcester, Mass.





Pictured at the Buffalo Works of the Worthington Corp. is a twin cylinder vacuum pump used for electrical power station service. Although Worthington is known as the world's largest manufacturers of pumps, the company has developed 13 other major product lines.

Chevrolet personnel complete the hook-up for the first test run of the Wright engine at the firm's Aviation Engine Div., Tonawanda.



A crank case sub-assembly at the Chevrolet plant is shown about ready to receive cylinder heads and the balance of working parts.

Welcome Planned for 500 Members of ASTE

By Nancy L. Morgan

Located in downtown Buffalo, the Statler Hotel will serve as the headquarters for visiting ASTE members and their wives attending the two-day International Area Meeting and 20th Semi-Annual Meeting.

As last-minute details are being handled for the International Area Meeting program, some 500 ASTE members, including national officers, directors, committee men and industrial executives in the area are making their plans to attend the meeting on October 10 and 11 at Buffalo's Statler Hotel.

Participating members, representing a dozen chapters of the Society, will hear a banquet address Friday evening by one of the nation's outstanding business leaders, James Y. Scott, who is president of the Van Norman Co. of Springfield and the Morse Twist Drill and Machine Co. of New Bedford, Mass.

A member of the Machine Tool Advisory Committee of the NPA, Mr. Scott is a past president of the National Machine Tool Builders Association and throughout World War II served in many advisory capacities to various government agencies. He is a director of six Springfield firms and is a trustee of Springfield College, Springfield Institution for Savings, Springfield Hospital, Eastern States Exposition and the United Fund of Springfield.

For members of the Society holding national office, much of the time at the area meeting will be devoted to discussion, analysis and concentrated study of ASTE activities. The board of directors will meet all day Friday and again Saturday morning and afternoon. Members of the national public relations committee and the national membership committee will also hold meetings Saturday.

Wives coming to Buffalo will take part in the radio program "Breakfast at the Lennox;" attend a style show and tea at Sattler's Department Store; tour the Ontario hydro plant at Niagara Falls and have luncheon in the Rainbow Room in the General Brock Hotel overlooking the falls.

Plant tours are always an important part of local and national ASTE programs. The International Area Meeting boasts three excellent visitations planned so members will not have to miss any of the equally fine technical sessions.

Just opened to visitors in September, the new stamping plant of the Ford Motor Co. will be a "must" for every ASTE member. Ford's system of automation, the efficient automatic handling of materials during manufacturing processes, is one of the outstanding features of the Buffalo plant.

Automation consists of transfer conveyors and mechanical devices which load and unload stamping and welding presses. These load blank sheets of steel and panels into presses, remove

Above: Two welding presses form an automated unit for welding various reinforcing parts of Ford inner door panel at the Buffalo Stamping Plant. Right: A Ford passenger car floor panel is being automatically removed from huge metal stamping press by "mechanical hand" at the Ford plant.

ASTE wives attending the Buffalo meeting will have luncheon in the Rainbow Room (right) of the General Brock Hotel, overlooking Niagara Falls.

them, turn them over if desired, and deliver them to the next operation.

Society members will have opportunity to tour the Tonawanda plant of Chevrolet Div., General Motors Corp., which turned out its first aviation engine on July 29 of this year. The model was a Wright R-3340-26W, developing 2,700 hp. A second and larger aviation engine, the supercharged R-3350-85, developing 3,500 hp, is due in November.

Also scheduled on the list of area meeting tours is the Buffalo Works of the Worthington Corp., until recently known as the Worthington Pump and Machinery Corp. Founded in 1840, Worthington is known as the world's largest manufacturer of pumps, but has also developed 13 other major product lines which are manufactured in 21 plants throughout the world.

ASTE visitors at the Buffalo Works will study Worthington methods in manufacturing air and gas compressors, diesel and gas engines and multiple v-belt drives.

Four technical sessions complete the well-rounded area meeting program. Friday morning Wiliam W. Schug, general sales manager, The V & O Press Co., will deliver a lecture on "Utilizing Machine Press Capacity Through Dial Feeds."

Saturday programs will cover: "Electro-Mechanical Machining of Hard Materials," by M. F. Judkins, chief engineer, High Temperature Alloys Div., Firth-Sterling Steel & Carbide Corp.; "Tool Stores and Maintenance," by Terence F. Dundon, tool supervisor, The Carrier Corp.; and "Hi-Jet Lubrication," by B. R. Walsh, head of the industrial engineering section, Gulf Research & Development Co.

James Y. Scott

William W. Schug

M. F. Judkins

B. R. Walsh

Technical Program

Friday, October 10

10 A.M.

Technical Session
Board of Directors Meeting
"Utilizing Machine Press Capacity Through Dial Feeds"
William W. Schug, General Sales Manager
The V & O Press Co.
Plant Tour
Worthington Corp.

2 P.M.

Board of Directors Meeting
Plant Tours
Chevrolet Aviation Engine Div., General Motors Corp.
Stamping Plant, Ford Motor Co.
Worthington Corp.

7 P.M.

Banquet
Ballroom, Statler Hotel
Keynote Speaker:
James Y. Scott, President
Morse Twist Drill and Machine Co.

Saturday, October 11

9 A.M.

Technical Sessions
"Electro-Mechanical Machining of Hard Materials"
M. F. Judkins, Chief Engineer
High Temperature Alloys Div.,
Firth-Sterling Steel & Carbide Corp.
"Tool Stores and Maintenance"
Terrence F. Dundon, Tool Supervisor
The Carrier Corp.

10:30 A.M.

Technical Session
"Hi-Jet Lubrication"
B. R. Walsh, Head
Industrial Engineering Section
Gulf Research & Development Co.

International Area Meeting Committee Chairmen

W. J. Reich
Host Chairman

List Members Responsible for Coordinating Meeting Activities

Committee chairmen who are not pictured here include: J. A. Monneypenny, banquet; G. C. Kingston, entertainment; P. C. Richardson, reception; E. A. Slate, technical activities; Paul Knopp, plant tours; Otto Guenther, technical sessions; Al Stone, photography; and J. R. Fisgus, housing and accommodations.

W. L. Clarke
General Chairman

R. W. Fitch
Ladies' Activities

W. J. Iekel
Social Program

C. S. Oliver
Transportation

A. F. Thormahlen
Tickets

George Rathman
Signs

J. D. Reed
Emergencies

E. J. Boggan
Records and Reports

H. W. Ellis
Supplementary

V. F. Villela
Publicity

E. D. Csont
Session Arrangements

G. A. Carroll
Registration

R. S. Slate
Budgets

Study and analysis of the constitution and by-laws of the Society was the primary objective at the August 22 and 23 meeting of ASTE's national constitution and by-laws committee. Meeting at national headquarters in Detroit were (left to right): First Vice President Joseph P. Crosby, Chairman E. H. Ruder, Harry Z. Marx, John X. Ryneska and Edward J. Berry. The group is planning revisions of the Society procedures manual.

University of Illinois Conference Planned

The Second Annual Tool Engineering Conference for ASTE chapters in Illinois, Wisconsin, Indiana and Western Michigan has been scheduled by the Chicago chapter for November 8 at the University of Illinois in Urbana, in cooperation with the mechanical engineering department and the extension division of the university.

An extensive program of current interest for tool engineers is being planned under the leadership of L. E. Doyle, associate professor of mechanical engineering and member of the Chicago chapter.

A highlight of the conference will be a round table discussion of carbides and their application with the theme "Engineering the Carbide to the Job." Prof. K. J. Trigger and representatives from leading carbide manufacturers and industrial users will participate in a discussion of their experiences with carbides and a question and answer period with the audience. Other technical meetings will be held on die casting, forging, safety in tool engineering, and time and motion study applications in tool engineering.

The recently organized professional engineering committee will present a program to foster increased professional development in ASTE. A discussion on the value of professional engineering registration will be held by leading professional engineers and members of several state boards of registration.

A complete tour of the College of Engineering will be conducted to help ASTE members and guests become better acquainted with the production, design and power laboratories in the department of mechanical engineering; the facilities in metallurgy and ceramics; the huge but delicate testing equipment in Talbot laboratory; the latest development in electronic computers; the railroad shops and the physics department. Also scheduled is a lecture on the 240-million volt Betatron.

The ladies program will feature tours of the home economics and art departments and an informal social program.

Los Alamos Chapter Hears Atomic Scientist

Los Alamos—Dr. Alvin C. Graves, who has played a very important part in the development of the atomic bomb, was the guest speaker for the August 7 meeting of the Los Alamos chapter. The 219 members and guests who attended were screened by the FBI before hearing his restricted talk.

Dr. Graves came to Los Alamos in 1943 as group leader, was later appointed associate division leader, and is now division leader and scientific test director of all atomic tests. The material in his speech, as well as the slides and films shown, contained secret information.

Named Board Chairman

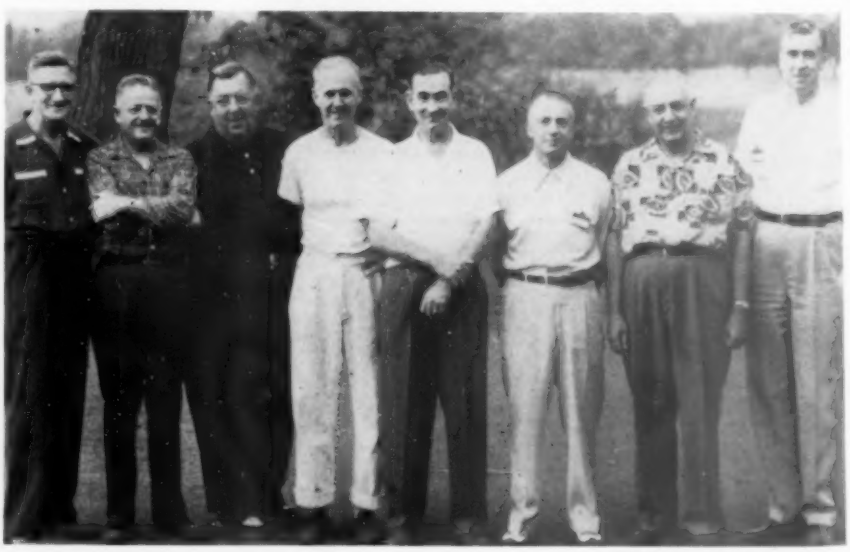
Harry E. Sloan of the Hartford chapter has been elected chairman of the board of directors of the Cushman Chuck Co. Mr. Sloan, who has been with the company for 53 years, has served as president since 1928. His son Harry E. Sloan, Jr., also a member of the Hartford chapter and formerly vice-president of the firm, is the new president.

Another Hartford member, William C. Gaw, was elected vice-president in charge of sales for the company.

Observes Anniversary

Marking 50 years with the Norton Co., William N. Jove, member of the Society's Chicago chapter, recently received a diamond lapel pin. Mr. Jove is the company's abrasive engineer in Chicago.

Included in the huge crowd of Detroit ASTE members who participated in the chapter's annual golf outing were seven past chairmen of the organization. Pictured at the gathering, from left, are: Lee Diamond, chairman for 1941-42; Wayne Kay, 1945-46 (now national editorial chairman); W. B. McClellan, 1946-47 (now a national director of the Society); Andrew Carnegie, 1948-49; Monta Cox, 1949-50; Charles Smillie, 1950-51 (now national professional engineering chairman); Doug Anderson, 1951-52; and Edward Wiard, current chairman.



Hody's Restaurant in North Hollywood furnished the setting August 6 for the charter night ceremonies of the San Fernando Valley ASTE chapter. This newest ASTE group is the 99th to join the Society family since its founding in 1932.

ASTE's 99th Chapter Receives Charter

Chartering ceremonies held in North Hollywood, Calif., on August 6 launched ASTE's newest chapter, San Fernando Valley, on its first year of activities. The charter, presented by National Director Ben J. Hazewinkel, is the 99th to be given since the Society was founded some twenty years ago.

Dinner at Hody's Restaurant preceded the evening's program which also included a technical session on "Induction Heating" delivered by Dr. H. B. Osborn, Jr., third vice president of ASTE and technical director of TOCCO Div., Ohio Crankshaft Co., Cleveland.

San Fernando Valley officers, installed by Dr. Osborn, are: Arthur D. Lewis, chairman; Rudolf Regen, first vice chairman; Rudolf Powroznik, second vice chairman; R. A. Benton, secretary; and K. C. Kerseg, treasurer.

Mr. Lewis received the chairman's pin from Louis Behler, charter chairman of the Los Angeles chapter. Wayne Ewing of the national membership committee presented the membership kit and a gavel was given to the new chapter by Frank Wallace, chairman of the Long Beach chapter.

Names of the 196 San Fernando Valley members include:

Robert M. Adam, Stanley Adamick, John G. Antal, Norman W. Averill, Vick D. Babb, Otto Baker, Rudolph Balzer, Joseph F. Bangs, Arthur C. Bassett, Albert G. Bazar, Kenneth E. Beisner, Ralph A. Benton, George Vernon Bentz, Louis Biehler, Roy A. Bjorklund, James P. Bordner, James A. Broadston, Robert C. Broomell, George Brundage, Jr., Alfred J. Bunje, Frank W. Butler, John A. Byrone, Richard R. Cannon, Robert W. Carr, Charles Castiglia, Rodney R. Clarke, Rolland W. Collar, J. Vernon Crooks, Jack E. Dain, Anthony J. Dallas, Charles A. Dawson.

Emanuel H. Derry, John E. Dewey, B. Gary Diamond, John F. Dooley, Jr., Ralph F. Dorn, Robert L. Dorsch, King B. Drake, Joseph C. Dunlap, Warren F. Edmundson, Clifton L. Englis, William F. Ensrud, Donald W. Every, Albert H. Farnes, James N. Faulkner, Edward G. Ferguson, A. Milton Finkel, Alden E. Foster, William F. Foth, Emil Freese, Raymond E. Furness, John C. Gerdes, George A. Gerstmeier, Charles L. Goodspeed, Fred C. Gossett, Lyle S. Gray, Gustaf A. Gredin, Keith H. Griffin, Robert E. Haines, Cline O. Hall, Walter E. Harmon, Edwin R. Heffleger, Arnold M. Helgeson, Weart C. Helton, Gifford L. Hitz, Arthur E. Hunter, Theodore E. Hursh, Howard G. Jordan, Eugene S. Kaynor, Lloyd C. Keeler.

More members are: Frank J. Kern, Kurk C. Kerseg, Robert F. King, William C. Koenig, Nick L. Konas, Harry Kurz, Mark J. La From, Kenneth F. Lagerson, John La Monica, Andrew H. Langdon, Ronald J. Lanphear, Richard E. Lehman, Arthur D. Lewis, Dick R. Linch, Lorentz J. Lindquist, John F. Lipscomb, Paul M. Lloyd, Henry Ludwig, Bernie F. Lundberg, Frank A. Mack, Warren M. Mansfield, Matthew M. Margulies, Edwin H. Martin, Walter Matakovich, Joseph T. Matheny, William F. MacFarlane, Lester J. Merchant.

Joe Merchasin, Robert A. Merrill, Jr., Harold L. Miller, J. M. Miller, Malcolm M. Miller, Francis J. Mohr, William H. Morin, Robert E. Morse, Francis B. Murphy, Walter E. Murphy, Earl G. Murray, Clifford H. Nelson, Vernon J. Nelson, Frank E. Netherton, Herbert L. Newcom, Paul Nicholas, Verne G. Olson, Robert Orr, Donald A. Palmer, George W. Papen II, Joseph A. Parks, Arthur B. Pennala, Robert M. Perkins, Albert V. Perrault, Alfred H. Petersen, Robert M. Philgren, Herbert L. Phillips.

Henry R. Powroznik, Edward J. Ramaley, Alfred T. Rando, Homer E. Rathbun, Sr., William H. Reko, Frank J. Restrich, Arthur L. Rhoads, James H. Richards, Walter H. Righter, Gerald R. Rocklein, Raymond W. Ross, Ivan L. Rubenstein, Richard F. Sanford, Ralph D. Sauter, Harold F. Schaffer, Howard L. Schalk, Bernard F. Scherer, Adolph Schlesser, Herbert T. Schramm, James C. Scullin, Charles L. Seaton, Edward J. Shields, Dante A. Silveri, Irving P. Simonson, Francis W. Smith, James L. Smith, Arnold J. Soares, Vivian M. Solt, Lee F. Spayd, Lee M. Springer, Harry W. Stannard, Charles H. Stevens,

(Continued on page 91)

Program Set for ASTE's 100th Charter Night

An extensive program has been planned for the more than 500 members and guests expected at the chartering of ASTE's 100th chapter on October 14, at Athol, Mass. The new organization, to be known as the North Massachusetts chapter, will include members from industrial firms in the cities of Greenfield, Gardner, East Templeton, Orange, Winchendon and Athol.

Tours are scheduled for the plants of the L. S. Starrett Co. and the Union Twist Drill Co. A get-acquainted gathering will be held in the Pequoig Hotel preceding the banquet in Athol Memorial Hall.

Toastmaster at the banquet will be A. H. d'Arcambal, past president of the Society. The speaker of the evening will be Roger Gay, president of the Bristol Brass Co. and president of the American Standards Association. He will talk about the general economic outlook for manufacturing. Entertainment will be furnished by the Union Twist Drill Employees' Glee Club.

Worcester's ASTE chapter, which sponsored the new group, is making the chartering ceremonies their regular October Executives Night meeting. Executives of the area will be guests at the affair.

The actual chartering ceremonies will be conducted by past presidents of the Society. National officers who will take part in the ceremonies are: President L. B. Bellamy, First Vice President R. F. Waindle, Second Vice President J. P. Crosby and Executive Secretary H. E. Conrad.

Pro tem officials of the new chapter are: Dr. W. R. Frazer, chairman; G. H. Stimson, first vice chairman; L. W. Tourigny, second vice chairman; R. H. Tolman, secretary; and E. D. May, treasurer.

Four past presidents of the Society were on hand to help other Detroit ASTE members uphold the chapter traditions at the annual golf party. Pictured, from the left, are: Albert M. Sargent, who headed ASTE in 1946-47; Frank Curtis, president in 1941-42; William H. Smila, who served in 1933-34; and Walter F. Wagner, president in 1938-39.

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Elmira Chapter Plans 1952-53 Activities

Elmira—A business meeting was held August 11 at the Mark Twain Hotel by Elmira ASTE members to outline programs for the coming year. The October technical session will feature a plant tour of the Ithaca Gun Co. Members of the Binghamton chapter will also participate.

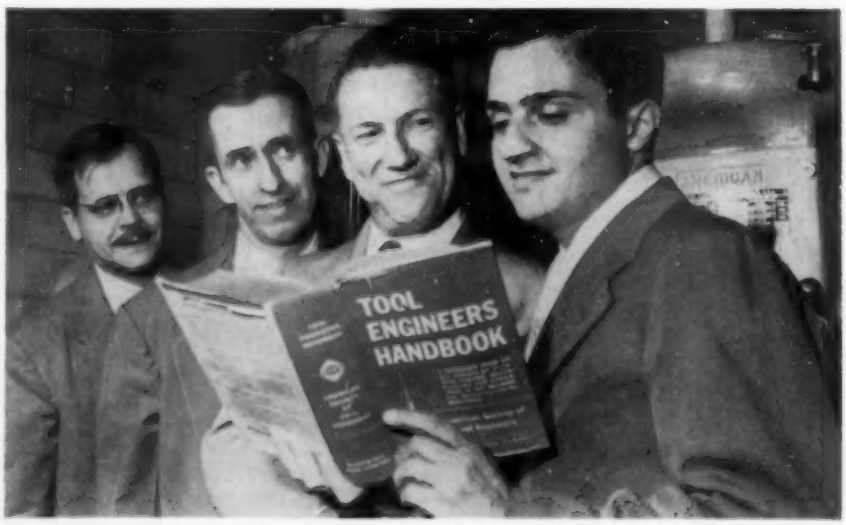
Past Chairman Henry LeMaire was appointed head of the transportation and reservation committee of the area meeting to be held in Buffalo October 10-11. The entire chapter was encouraged to attend the scheduled plant tours, technical meetings and banquet.

The chapter voted to present a membership pin to each new member who joins the Elmira ASTE group in the next year.

Edmund Bachand Named Detroit Branch Manager

ASTE member Edmund D. Bachand has been appointed manager of the Detroit branch office of Moore Products Co. He succeeds J. E. Gambrill, who becomes manager of a new branch office in New York City.

Since 1945, Mr. Bachand has been associated with the home office in Philadelphia, as a sales engineer specializing in pneumatic comparator gages. He was formerly a gage engineer with American Bosch Corp. and an ordnance inspector for the Springfield Ordnance District, during which time he was active in the Springfield ASTE chapter.



Amanuel T. Fundoukos, senior in the mechanical engineering department at the University of Akron, was awarded a *Tool Engineering Handbook* by the Akron chapter for being an outstanding student in machine design. At the presentation were, left to right: Frank A. Flannery, education chairman; A. O. Hunt, chapter chairman; and Mr. Fundoukos.

Boston Member Addresses Management Association

Boston—Edward M. Dowd, Boston member, was a featured speaker on the first day of a personnel conference of the American Management Association at the Hotel Astor, New York, Sept. 29-Oct. 1.

Approximately 1,500 industrial relations executives and other representatives of man-power management, heard the executive vice-president of Lapointe Machine Tool Co. His speech, "Raising Productivity, Profits and Pay," covered a case history of the Scanlon Plan as applied by union and management.

Positions Available

TOOL AND MACHINE DESIGNERS —One of Cincinnati's largest permanent design firms has openings in their own office for experienced machine, product and tool designers, and detailers.

Recent engineering graduates or students will also be given consideration. These are permanent positions with a substantial, stable leader in the field. We can offer top starting wages, modern working conditions, paid holidays, vacations, and other benefits. Our policies assure varied experience and unusual opportunities with a future.

New employees would be expected to settle on a permanent basis in Cincinnati. Please send resume to Cincinnati Designing, Inc., 37 W. Seventh St., Cincinnati 2, Ohio.

DESIGN ENGINEER—Excellent opportunity now exists in our Mechanical Design Division for an experienced graduate mechanical engineer. Minimum education—BS degree—with MS degree preferred. Five to ten years of tool design experience and/or machine shop practice required. Preferred age —30 to 35. Job location is Akron, Ohio. Reply by stating education, work experience, and salary desired. David Thomas, Sales and Office Personnel, The Goodyear Tire and Rubber Co., 1144 East Market St., Akron 16, Ohio.

99th Chapter Chartered

(Continued from page 89)

Robert L. Stevens, Karl H. Storkel, James L. Stormont, Edwin J. Strand, Anthony W. Suk.

Michael Surwill, William C. Surwill, James Sutton, Anthony Tamborello, Charles K. Taubert, Paul L. Thompsen, T. H. Thompson, Jr., John R. Tildsley, Ernest C. Timmsen, Edward H. Tumbusch, Albert B. Underwood, Michael W. Vigh, G. J. Walkey, Edwin H. Waltke, Jr., Bernard C. Watson, Neil G. Wesley.

Harry G. White, Jr., Marion D. Whitehead, Philip J. Wiegand, Floyd S. Williams, Roy E. Wilson, Henry T. Young, R. George Zeryneith.

Cleveland Chairman Andy Clark, left, and golf winner "Doc" Osborn.

Cleveland Entertains 175 at Golf Party

Cleveland—The Cleveland chapter held a golf party for 175 members and guests at the Lake Forest Country Club in Hudson, Ohio.

A golf trophy donated by Darwin Milner Inc., Cleveland, was presented by James D. White, general manager of the company. H. B. Osborn, Jr. won the first prize with a low gross score of 77.

A buffet dinner and presentation of the prizes ended the day's events. Pat Taverna and Jim McIntyre were co-chairmen of the golf party. Phil Phisback was the official photographer for the event.

Meeting Features Films

The Binghamton chapter started the autumn schedule of meetings and technical sessions on September 9 with two motion pictures. Sixty members met at the Vestal American Legion Hall to view the films, which were produced by the General Motors Corp. They were titled, "Quality in the Making" and "Micro Instrument Ball Bearings, Their Care and Handling."

Hamilton Chapter Presents Field Day

Hamilton, Ont.—About 240 members and guests attended the Hamilton chapter's annual field day at the Dundas Golf and Country Club.

A feature of the day was a golf tournament for the Pellers Golf Trophy. Fred Belowitz turned in the winning score for the first-prize trophy. About 50 contestants entered the putting contest, conducted by Clarence Bulmer.

David Wilson conducted the horseshoe pitching contest in which Lesle Paine and Jack Hillier defeated some 40 other contestants to win the event. George Gilmount was in charge of a lively nail-driving contest.

A Lord Elgin wrist watch, engraved with the ASTE crest was donated by the W. F. Graig Machine Co., Woodstock, and was presented by Entertainment Chairman Lorne Coady.

Plant Tour Draws 65 Williamsport Members

Williamsport—A tour of the tank engine plant of Lycoming-Spencer, division of AVCO, was featured by the Williamsport chapter at its September 8 meeting. Sixty-five members and their guests had dinner in the plant cafeteria where a motion picture called "Precision for Production" was shown the ASTE audience.

A highlight of the tour was the fabrication lines for crankshafts, camshafts, cylinders and other parts.

New Post for Boegner

Albert W. Boegner of the Philadelphia chapter has been appointed purchasing agent for the new Colmar, Pa., plant of the Link-Belt Co. Mr. Boegner has been with the firm since 1936 and was formerly purchasing agent for the Philadelphia plant.

Melvin Meyer, winner of the Milwaukee ASTE chapter's fourth annual scholarship, is pictured just after the presentation with F. W. Ziegenhagen (left), principal of Boys' Technical High School; and R. A. Radtke, chairman of the chapter's education committee.

Early Days of ASTE Recalled

By Andrew E. Rylander

Writing in late August to meet the October deadline, I'm still in the summer doldrums. In terms of the October issue, however, chapter activities for the fall season started last month—September. A screwy proposition, what? Which brings up another one: If a jet plane can make 2000 mph, which is twice as fast as the hourly rotation of the earth, how long would it take to arrive at V-K day—V-K standing for the end of the cold (?) war in Korea—if a day is gained on each lap?

This month—October, that is—the ASTE holds its 20th Semi-Annual Meeting and charters North Central Massachusetts as its 100th chapter. Then comes 101 as the start toward chapter No. 200 which, at the present rate of acceleration, should be in the fold well within the next decade. Watch us grow!

Twenty years may seem a long time to younger members who were in their swaddling clothes when the ASTE was started in O. B. Jones' Detroit College of Applied Science. During the years, the hair has grayed on the heads of most of the charter members, some of whom have gone to their final reward; yet, even they lived to see the ASTE become a major force in the engineering world.

But oh, the "first hundred years!" But then, I've told that story before and no use rehashing the trials and tribulations of the early days. Just the same, it may be as well to let the new members know that the prestige they now enjoy as members of the world's fastest growing engineering society is due in large degree to the old timers who blazed a trail to recognition when the going was tough.

Sargents' Contributions

In this conection, I would be remiss if I did not pay tribute to Al Sargent and his wife, both of whom gave generously of their time when red ink flowed so thick that we didn't even have rent money. Al gave us office space and secretarial service—the latter via his silent (?) partner—the while he served personally as national secretary.

That, by the way, was an optimistic title since, at the time, the ASTE was a local to all practical purposes with a total membership less than that now enjoyed by many of our chapters. Sure, others were there too, and I only wish I had space to give credit to all who have practically made the ASTE one of the main purposes of life. And as the Good Book puts it: "He who gives his life shall have it."

We became a "national" organization when Racine joined in the middle 30's, to be followed by Cleveland, Milwaukee, Chicago, Fairfield County, Hartford, Pittsburgh, Toledo, and Buffalo-Niagara in that order up to No. 10. Crowding the border, the latter chapter eventually opened the gates into Canada where we became an international order and got some mighty fine members and an outstanding president, Bob Douglas.

Responsibilities Combined

Incidentally, most of these chapters came in during my incumbency as secretary—the first, by the way—of Detroit chapter. Otto Winter had been elected chairman but, having come down with a bad case of *wanderlust*—he'd just got back from abroad and could say *kaput* like a native Muscovite—he up and hied himself to Toledo, where he organized chapter No. 9. That left me doubling in brass; keeping records, accounting to Bill Smila—then chapter treasurer—for the scanty wampum, selling tickets at the door, then up to the head table to preside as substitute chairman.

So, when the next year's election of officers came due the nominating committee said "Andy's been chairman; let's nominate someone else." So, I missed getting into the ASTE Hall of Fame, let alone being recipient of one of these fancy souvenir buttons they give to past chairmen. But that's all okay.

One by one the chapters began rolling in, each bringing good men into the Society, some to become directors, some to ascend to our highest office, all of them together giving of their time and loyalty that the ASTE might grow and prosper. Came the first ASTE tool show, so successful that these became a biennial institution; then, as a major if not an ultimate goal, our own home at 10700 Puritan Avenue, Detroit. So now, the ASTE is "big business," and all that within a scant 20 years. Progress, what? Well, I could go on and on and still only hit the high spots. Maybe I'll write a book about it someday.

Golden Gate Program

Anyway, there's not much news in retrospect as far as the West Coast chapters are concerned. That is, I wasn't there to report it, as for example, the chartering of San Fernando Valley and the August meeting at Santa Clara Valley. Now, starting with the fall term, Golden Gate chapter sponsors another education program—"Fundamentals of Tool Engineering"—with cooperation of Oakland Public Schools. Henry De Coursey of Golden Gate chapter will serve as instructor.

Here, however, is good news for the West Coast: I've just had word from Prex Les Bellamy that he is coming out here in November, when he plans to visit at least six of the West Coast chapters. I have known Les for many years, have seen him serve capably as committee head, chapter officer, and national director, in each capacity giving everything he had to the ASTE. In my belief—and this casts no reflection on his predecessors—he is easily one of the Society's outstanding executive officers.

That he is going to get a royal welcome out here goes without saying; however, I'm jumping the gun with this announcement so as to give our boys out here a chance to plan their doings on the occasion of his visit. In this connection—and understand, now, this is only a suggestion—it would be nice if the West Coast chapters could coordinate their meeting dates so as to provide ample travel time from one point to another. Let's see what we can do, then, toward an outstanding welcome to an outstanding ASTE'er.

Obituary

CORRECTION: Unfortunately, the August issue announced the death of Albert D. Forbes instead of Mrs. Forbes who died on May 16. Mr. Forbes, charter chairman of the Boston chapter is associated with the General Electric Co., serving in various capacities during the past 35 years. Our sympathies and apology for the error are extended to Mr. Forbes and his friends.—Ed.

Coming Meetings

INTERNATIONAL AREA MEETING—Oct. 10, 11, Hotel Statler, Buffalo, N.Y.

SECOND ANNUAL TOOL ENGINEERING CONFERENCE—Nov. 3, University of Illinois, Urbana.

CHICAGO—Oct. 6, Keymans Club. Stanley Cope, president of the Acme School of Die Design, will speak on "Processing and Designing Dies for Drawn Stampings."

COLUMBUS—Oct. 8, Columbus Maennechor. William W. Schug, general sales manager, The V & O Press Co., will speak on "Presses Geared for Automatic Production."

TWIN CITIES—Oct. 1, Covered Wagon, Minneapolis. Technical session will be held on "Method X."

Annual Outing Attracts 350 Philadelphia Members

Philadelphia—The Philadelphia Rifle Club furnished the setting for the ASTE chapter's annual outing on June 7. About 350 members and guests attended the event.

Clear weather aided the enjoyment of baseball and other outdoor recreation. Dinner and entertainment concluded the day's activities. More than 150 door prizes, donated by firms in the Philadelphia area, were awarded.

Schimpf Participates in Westinghouse Ceremonies

Ray J. Schimpf, supervisor of tool engineering at the Lima, Ohio, Westinghouse plant and chairman of the ASTE chapter in Lima, participated in the recent graduation ceremonies for four newly-certified journeyman tool and die makers at Westinghouse. Congratulations to the graduates were extended by Joseph C. Doyle of the U. S. Department of Labor's Bureau of Apprenticeship, Instructor Claire Staup and William W. Chambers, supervisor of Vocational education for the Lima School board.

Cleveland Chapter Holds Family Picnic

Cleveland—The annual family picnic was held at Astorhurst Park in Bedford for about 150 Cleveland members, their wives and children.

Nearly everyone present entered one or more of the events of dexterity. Again this year, the day was climaxed with the ball game between the "Peddlers" and the "Engineers." The announced score was 5 to 4. Both sides claimed the victory. The umpire reserved judgment since he was not watching the game. The long-standing rivalry between the two teams has a history of some 20 games.

Prizes donated by Cleveland industry were awarded to everyone present.

Graham Promoted

Peterboro chapter's Third Vice Chairman Jack Graham has been promoted to production engineer of the Western Clock Co. Mr. Graham joined the firm in 1936 as an apprentice toolmaker. On leave of absence, he attended the Elgin Watch School and was later transferred to the superintendent's department.

Rockford ASTE member Al Seeger receives Elgin wrist watch from Chairman Bruce Lundgren at the chapter's annual golf party held at Mauh-Nah-Tee-See Country Club. Nearly 200 members turned out for dinner and stag outing.

Williams Replaces Ford At Gas Turbine Plant

Detroit member Earle D. Williams has been appointed manager of quality control, Gas Turbine plant, Lincoln-Mercury Div., Ford Motor Co., replacing William Clay Ford, who has assumed other duties. Mr. Williams was formerly manager of manufacturing engineering, Lincoln-Mercury Div., and recently was production manager of the engine assembly and testing operations, Gas Turbine plant.

Joins Lincoln-Mercury

Robert S. Cluff, member of the Detroit chapter, is now vendor coordinating engineer at the Gas Turbine Plant of Lincoln Mercury Div., Ford Motor Co. He formerly served as president of the Equitable Engineering Co.

Santa Clara Members Tour Westinghouse

The Westinghouse Electric Corp. was host to 150 ASTE members and guests of the Santa Clara Valley chapter for a tour of the Sunnyvale plant on July 15. The group visited the manufacturing and testing facilities of the firm.

After dinner in the plant cafeteria, R. L. Everett, industrial relations supervisor, welcomed the group and pointed out diversification of equipment available and the variety of products manufactured by Westinghouse. F. L. Tippett, quality control supervisor, briefed those present on the construction and operation of the multi-million volt surgegenerator used in testing insulation.

The group saw a 40-foot Mesta boring mill, one of three in the nation; a 120-inch Fitchburg lathe; a 15x30-foot Craven planer; and the west coast's most modern and complete shop for small machining. The tour also included 120x180-inch gear hobbers built at Sunnyvale from Gould & Eberhardt design.

Indian Member Needs Engineering Periodicals

A call for past issues of THE TOOL ENGINEER and other periodicals on tool engineering has been sent out by F. N. Patel, senior member in Kanpur, India. Mr. Patel is planning to present his collection of books and magazines to an Indian library when he retires and would appreciate receiving any pertiment material from other ASTE members. Copies of the magazine, prior to January 1948, and other appropriate periodicals should be sent to Mr. F. N. Patel, Senior Scientific Office, c/o T.D.E.L., Post Box 320, Kanpur, India.

Bud Hilton (far left), Westinghouse foreman, shows Santa Clara Valley members the motor building aisle at the group's July 15 tour of the Sunnyvale plant. Other operations were explained by R. L. Everett and F. L. Tippett.

20th Annual Meeting Papers Still Available!

The following technical papers, delivered in Chicago at the 20th Annual Meeting, are ready for immediate distribution. Mail your order today!

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S9	Selection and Treatment of Die Steels
S10	Automatic Size Control in Finish Grinding
S11	Precision Production Grinding
S12	Finish Grinding Troubles and Remedies
S13	Electronics in Motor Drives
S14	The Tool Engineer Chooses Pneumatic or Hydraulic Drives
S15	Mechanical Variable-Speed Drives
T1	Cooperation Between Research Centers and Engineering Societies
T2	The Function of Cutting Fluids in Modern High-Speed Machining
T3A	Relation of the Tool Engineer to Company Standards
T3B	The Part of Standards in Better Customer Relations
T4	Production Grinding of Cylindrical Parts Requiring Extreme Precision
T5	Producing Deep Holes by Trepanning and Drilling
T6	Broaching of Internal Gears
T7	Job-Tests Aid Production Personnel
T8A	New Precision Reference Specimens for Surface Finish Control
T8B	The Surfagage—An Instrument for Roughness Measurement
T9	An Analysis of Cost Estimating Principles and Practices
T10	Recent Advances in Metal Cutting Science and Practice
T11	Electro-Mechanical Machining of Hard Materials
T12	Tool Engineers and Electroforming
T13	Heat-Treating and Machining of Boron Steels
T14	New Developments in Cemented Carbides
T15	Multiple Screw Machine Tooling and Methods
T16	Power Chucking
T17	Strength of Bolted Assemblies
T18	Practical Aspects of Tool and Die Heat-Treatment
T19	Contour Milling of Sheet Stock
T20	Sand Casting with Croning Process Shell Molds
T21	Cupola Deoxidation Improves Machinability of Iron Castings
T22	Control of Quality on Mass-produced Engineering Parts
T23	Dynatomics—A New Concept in Metal Removal
T24	Improved Measurements as a Way Towards Safer Tolerances

Panel Discussions

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LS2P	Drilling
LS3P	Metal Stamping Dies and Operations
LS4P	Finish Grinding
LS5P	Machine Drives and Controls

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News in Metalworking

IMPROVED "DESEGATIZED" STEELS TO BE MARKETED

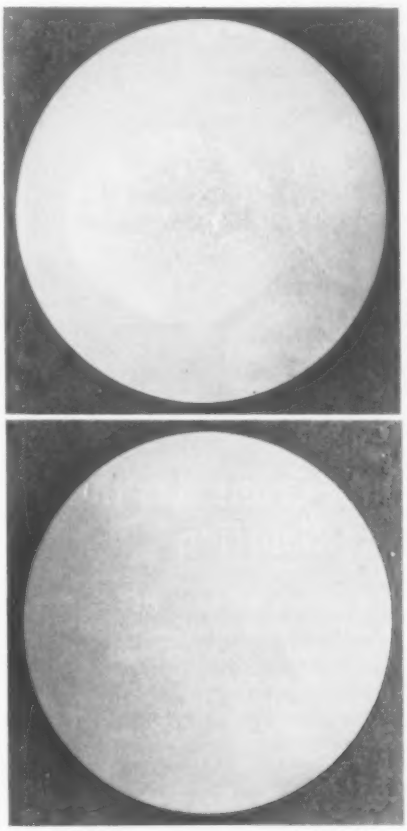
Tool steel producers have learned how to deal with most of the problems met in the production of high alloy tool steels, so that the user is reasonably sure that the steel he purchases is of the correct chemical analysis, that proper quality control has been exercised during the various manufacturing processes, and that carburization has been minimized.

Concentration or segregation of carbides in these steels, however, presents an additional problem that is not so easily solved. Metallurgists agree that the presence of free carbide is desirable in tool steel since this is what imparts wear resistance and abrasive properties so necessary in the tool steels required by the metalworking industry. The stumbling block here is that these free carbides do not remain equally dispersed throughout the steel as it is being worked and a concentration or segregation of these particles takes place when the usual methods of producing this type of steel are employed.

The tendency of these carbide particles is to migrate to the center of the tool steel bar where they form hard brittle clusters. The steel in this area of the workpiece is then a brittle core which will have a tendency to break under shock and impact. At the same time, the surface portions of the tool steel bar will be deficient in carbides, resulting in deleterious effects on the life of cutting tools made from the steel. During heat-treatment, further ill effects will be noticed because of the nonuniform results produced. The difference in reaction of the two areas to heat-treating will develop stresses in the material which will result in warpage and distortion during heat-treating, or brittleness which leads to tool breakage or premature failure in operation.

Some years ago the Latrobe Steel Co. introduced a "Desegatized" high-speed tool steel that was free of segregated carbides. The process was subsequently extended to the high carbon-high chromium die steels. The introduction of these "Desegatized" steels has changed the standards for carbide segregation so that there is no longer any necessity for using tool steels with excessive segregation, it is said.

Shown in the illustration are two sample inspection discs. The specimen above is cut from standard process material while the lower sample has been taken from a bar of "Desegatized" steel. The discs were hardened at the proper heat-treating temperature and tempered, polished until a mirror finish resulted, then etched in a five-percent nital solution for several minutes. This etching darkens the surrounding matrix but leaves the carbides unaffected and clearly visible. The sample at the top shows a concentration of carbides at the center of the standard process disc, while there is no concentration discernible in the "Desegatized" disc.



The Latrobe Steel Co. claims for its high-speed steels superior toughness, uniform heat-treating results, increased machinability and improved forming properties because of the techniques used in producing this "Desegatized" steel. It is further said that the size of the workpiece produced has no effect on the quality of the material.

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FLAME PLATING APPLIES METAL COATINGS

Flame plating is a method of applying powdered metals, such as tungsten carbide, to metal parts. The deposit is made in the form of a coating, and can be applied in thicknesses ranging from 0.0005 to 0.020 in. The coating is not diluted in any way. The process has been developed by the Linde Air Products Co., 30 East 42nd Street, New York 17.

One of the biggest advantages of this process is that the temperature of the base metal does not exceed 400 deg F during the plating operation, even when tungsten carbide is being deposited. The low-temperature deposition practically eliminates any possibility of a change in the properties of the metal being plated, and reduces to a minimum the chance that the part might warp.

The process is adaptable. Flat areas, cylinders, holes, and parts having various shapes and contours can be coated. Surfaces up to 6 in. wide and 40 in. long can be handled. The plated part can be used as-coated or ground to a mirror finish.

In the majority of applications listed to date, parts Flame plated with tungsten carbide have shown wear resistance equal, or superior to the sintered tungsten carbides, and vastly superior to cast alloys, hard chrome-plating, and tool steels. Parts Flame plated with tungsten carbide have all of the desirable properties of sintered tungsten carbide, such as resistance to abrasion and frictional wear, and in addition, have a lower modulus of elasticity, and greater resistance to impact and thermal shock.

Metals other than tungsten carbide have been deposited by this method. However, the bulk of the development work, and the greater portion of the field testing, has been accomplished with tungsten carbide.

Flame plating will be useful for protecting precision parts. Up until now, many of these parts were made of sintered tungsten carbide. When the surface wore away, the entire part had to be scrapped. Flame plating a steel part may prove to be an economical solution to this problem. Some of the parts that fall into this category are plug and thread gages and arbors.

The decision as to when to use this new process will have to be based on a number of factors. The cost of Flame plating a part, in actual dollars and cents, will fall somewhere between the cost of a hard-faced part and a sintered tungsten carbide. A Flame plated plug gage, for example, will cost more than a gage made of a cast alloy, but less than one made of sintered tungsten carbide. Of course, the outlay of dollars must be balanced against the service life. Very often the time and money a long-wearing part saves by reducing down time for maintenance and repair more than offsets its initial cost.

Through the use of the Flame plating process, tungsten carbide can be deposited on almost any base metal. Steels of all types, cast iron, aluminum, copper, brass, bronze, titanium, and magnesium have all been coated successfully by this method.

The size of the parts that can be Flame plated are limited by the handling equipment available at the present time. These limitations will be relaxed as the equipment is improved. The areas that can be coated vary with the shape of the part.

Flat surfaces 6 in. wide and up to 40 in. long can be Flame plated in thicknesses up to 0.020 in., providing the part is to be used in the as-coated condition. If the part is to be finish-ground, the width limitation is ¾ in.

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Cylindrical objects from 1/8 to 6 in. in diameter can be handled with the present equipment. Smaller or larger diameters may be plated but these would require special handling. The limitation on length is 40 in.

Holes or internal areas of cylinders can be plated to a depth equal to the diameter. A one-inch hole can be plated to a depth of one inch.

Irregularly-shaped objects can also be handled. The width and length limitations are the same as for cylindrical and flat areas. The rule on irregularly-shaped objects is that any area that can be covered directly from the horizontal plane to an angle no greater than 45 deg from the horizontal can be successfully Flame plated.

The parts to be Flame plated should be undercut just deep enough to allow for the desired thickness of the coating. It is advisable to leave a small protective lip at any edge where the part may be subjected to abuse or where two Flame plated surfaces are at right angles to each other. This is especially important on plug gages, shafts, spindles, and core rods.

Although the maximum thickness obtainable with a Flame plated coating is 0.020 in., few applications would require a thickness of over 0.005 in. A coating thickness of a few thousandths of an inch will resist mechanical and thermal shock to a much greater degree than will a thickness of 0.010 in. or 0.020 in. A coating thickness of 0.001 in. over the allowable wear tolerance is sufficient in most instances.

If the part is to be finish-ground an excess coating of 0.004 in. is deposited. However, it may be desirable to use the as-coated surface. This surface is 125 microinches, rms, as measured by a Brush Analyzer.

A Flame plated surface can be ground to a finish of approximately 2 microinches, rms. The surface of a coating that has been finish-ground appears to have a certain amount of microscopic porosity. These surface pores are extremely shallow and do not have a detrimental effect on the wear qualities of the coating.

Resinoid bonded diamond wheels are the only grinding wheels suitable for finishing a Flame plated surface. A 100-mesh wheel should be used for rough-grinding and a 400-mesh wheel for finish-grinding when no more than 0.0005 in. is to be removed. Before grinding, the flow of coolant should be adjusted so that the part is flooded. Fifty percent water and fifty percent soluble oil, or fifty percent kerosene and fifty percent spindle oil are good coolants.

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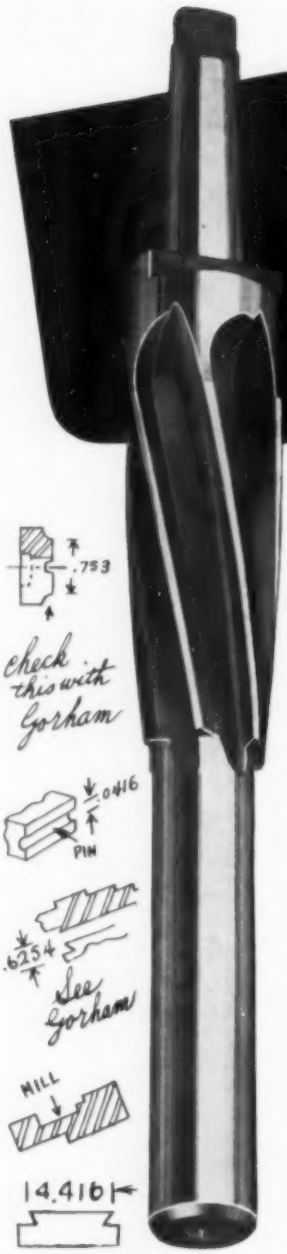
Turn problems into *profits*



with GORHAM-Engineered Special Cutting Tools

For fast, practical solutions to tough tooling problems, call in the expert . . . your nearby Gorham Field Engineer! He provides a complete engineering service to determine your exact tooling requirements. For instance:

•

He starts with your product, sketch or idea.

•

He surveys your production operations and your available equipment.

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He considers work material properties and desired finishes and tolerances.

•

He plots proper machine feed, speed and method of tool driving.

•

then . . . he develops practical design and engineering specifications for a special cutting tool, metallurgically "tailor-made" for your application.

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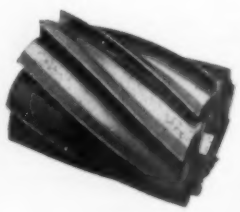
. . . *and* his recommendations are backed by Gorham's unmatched facilities! These include three fully-equipped manufacturing plants, large Engineering and Metallurgical staffs, and the finest heat treating equipment.

These resources, plus Gorham's more than thirty years' reputation for producing the finest cutting tools, are dedicated to furnishing prompt and profitable solutions to your special tooling problems. Gorham-engineered "specials" are turning problems into profits in thousands of plants every day . . . why not let them do the same for *you?*



If you haven't met your nearby Gorham field Engineer, write for his name, or send details of your problem direct for recommendations.

Gorham TOOL COMPANY

"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

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POWDER METAL PRESSES SPEED PARTS MAKING

A switch of methods by Pitney-Bowes, Inc., leading manufacturers of mailing machines, incidentally became case-history evidence for comparisons between methods of producing a variety of parts.

The change was made when three Stokes single-punch powder metal presses were installed to produce postage meter parts. At present the company is producing 90 oilless bushings and 20 structural parts, with an additional 12 powder metal parts planned for their current schedule.

William H. Diller, Jr., Pitney-Bowes' chief production engineer, reported that the company estimated a savings of 41.6 percent in manufacturing costs since the installation of the presses. He continued to say that their speed of operation had far exceeded that of former equipment, and in addition had proved ideal in almost all instances on the job for which they had been purchased.

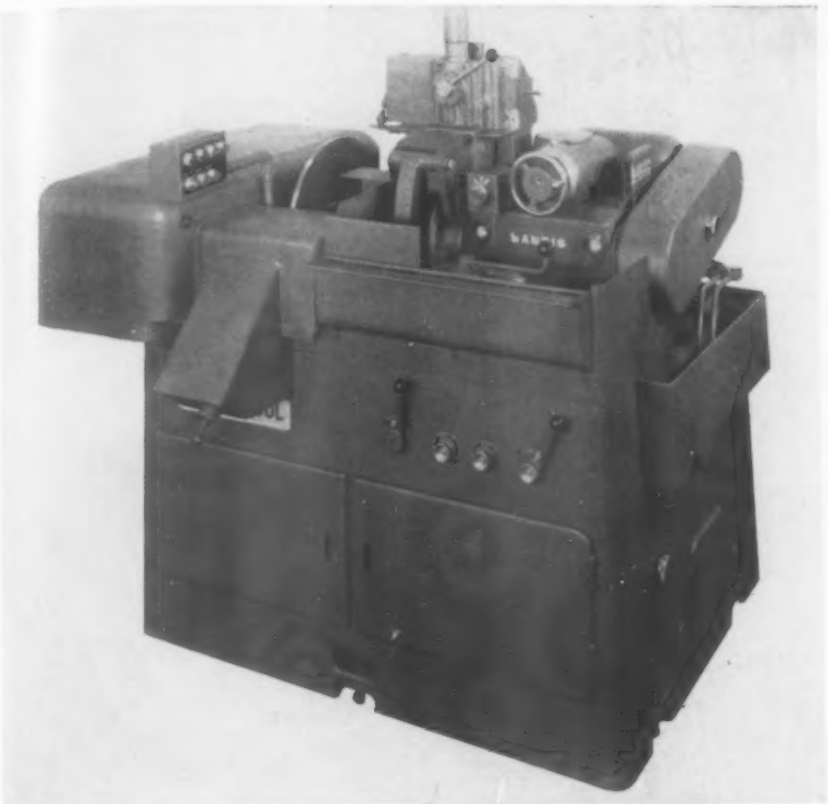
ASSEMBLY DEVICE INCREASES PRODUCTION

At Temco Aircraft Corp. the inner skins on Lockheed P2V Neptune outer wing panels were positioned in the assembly jigs by aligning their edges with marks on the jigs. Although this was a fairly tedious process, positioning devices appeared impractical since they

extended beyond the inner skins and interfered with the installation of the outer skins.

J. D. Bragg, a Temco production leadman—the man with the idea—suggested that spring-loaded stops having a diameter equal to the required spacing be made and installed on the leading edge jigs. Thus when the inner skins are butted against the stops and clamped to the jig, the proper spacing is assured. When the outer skins are installed later, the weight of the material pushes the stops back out of the way. Results, says the company, are that jig operations have been considerably speeded up, and rework due to improperly spaced skins eliminated.

Tools of Today . . . .



matic hydraulic wheel dressing is used for generating this shape on the wheel.

A variety of cycles may be had, depending on the part to be ground and the method of handling desired by the user. As an example, on parts without twist, a plunge grinding cycle could be used.

Metal is removed quickly and uniform work parts are produced. On a typical forged steel bucket, 1/8 to 3/16 in. of metal can be removed from the forging in one pass.

It is possible for one operator to run a battery of machines. Master cams may be easily removed when changing from one contour to another.

Hydraulic and electrical controls are grouped for convenient operation. Variable rates of hydraulic traverse are provided for both the wheel-base carriage and overhead dresser. Rates of hydraulic grinding feeds are variable and may be adjusted to suit the workpiece.

T-10-991

USE READER SERVICE CARD ON PAGE 101 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Semi-Automatic Jet Blade Grinder

This machine has been designed by the Landis Tool Co., Waynesboro, Pa., for rapid precision grinding of all types of blades, buckets, vanes and nozzles now being used in current jet engine designs. Uniform workpieces in size and shape are produced.

Of great importance is the fact that this machine will grind, with a large 24-in. diameter wheel, the leading and trailing edges in addition to the external airfoil surface, platform and platform radius.

Twisted, warped or broken back contours, straight contours and blades with parallel or nonparallel sides can all be precision ground on this machine.

Most of the blades which this machine will grind have a contour or airfoil shape which varies from root to tip. To grind this shape, as well as the leading and trailing edge, the Landis grinder uses a rocking cradle and master cam. As the 24-in. diameter grinding wheel traverses along the workpiece, the follower moves along the master cam.

The grinding wheel is profile dressed and, in addition, a radius is dressed on the corner for grinding the radius adjacent to the straight platform. Auto-

di-acro

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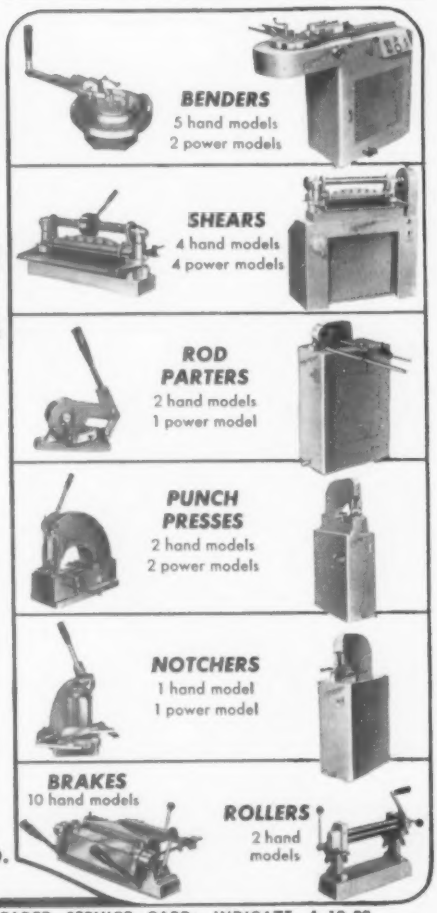

O'NEIL-IRWIN MANUFACTURING CO.
375 8th Ave., Lake City, Minnesota

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Keep your production line humming. Get in tune for maximum output with Simonds Abrasive Co. grinding wheels.

You will find plenty of satisfaction, savings and serviceability in these accurately specified production tools. Right now they're proving their adaptability, efficiency and economy in every phase of industrial grinding from production snagging to micro-inch finishing. Complete line includes grinding wheels, mounted wheels and points, segments and abrasive grain.

Write for free data book and name of your Simonds distributor.

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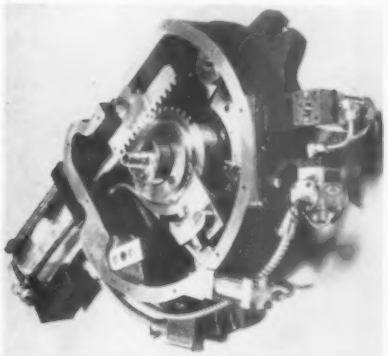
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-100

Rotary Index Table

An electrically controlled, air powered rotary index work feeder which positions work with great accuracy has been announced by The Bellows Co., 230 West Market Street, Akron 9, Ohio.

This rotary index table, model ERET-26, has a 26-in. diameter table top that is set to index either 6, 9 or 18 stations with repeat index accuracy of 0.001 in. on the table top. The table feeds work to and under drill press spindles, milling cutters, arbor and impact press rams, riveting heads, etc., quickly and with complete operator safety. The operator can load work at one station, unload at another, while work is being done at other stations, thus preventing non-productive loading and unloading time from cutting into the productive potential of machine tools.



The index table is rotated and positioned by a special $3\frac{5}{8}$ in. bore Bellows air motor complete with a built-in Bellows Electroaire directional valve and speed controls. This air motor develops a pressure stroke of 10 times air line pressure. A gear rack attached to the air motor piston rod drives a quadrant gear which rotates the table top a predetermined number of degrees in a clockwise direction. The Electroaire valve which operates the air motor is, itself, operated by 8-volt solenoid control units, which are guaranteed against burn-out.

The accuracy of rotary index table is the result of a unique shot-pin arrangement. Around the perimeter of the table top are 18 equally spaced, jig-bored holes—tapered and bushed to $\frac{3}{4}$-in. diameter. An auxiliary air cylinder, controlled by an additional Electroaire valve and synchronized to the movement of the table, drives a tapered shot-pin into the jigbored hole, positively and accurately locking the table, after cushioned air power has gently eased it into position.

All internal wiring of the table is connected to a convenient terminal box, mounted on the outside of the table. Fixtures can be mounted directly to the standard table top or to a second table top, which can then be mounted on the standard table top. **T-10-1001**

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

LITERATURE NUMBER	COMPANY	BULLETIN	DESCRIPTION
A-10-166-1	Ace Drill Bushing Co.	1101-S	Better bushings provide maximum accuracy at the right price. Special Sizes!
A-10-192-S	Acme Industrial Co.		New bushing catalog simplifies, speeds bushing selection.
A-10-143	American Wheelabrator & Equipment Corp.	43	Bulletin stresses advantages of Liquamatic Wet Blasting.
A-10-111	F. E. Anderson Oil Co.		20-page booklet contains information on machine cleaning, elimination of dermatitis and oder in machines, etc.
A-10-136	Armstrong-Blum Mfg. Co.	49	"Marvel" helps saw metal most efficiently—maintains balance of cutting speed and blade life.
A-10-232	The Bellows Company		"Foto Facts File" shows applications of "Controlled Air-Power" in plants.
A-10-209	Besly Welles Corp.		Grinding needs or problems solved by No. 226-30" double spindle grinders.
A-10-23	The Carborundum Co.		Free booklet "Causes and Corrections of Common Grinding Errors" available.
A-10-212-S	Chicago Rivet & Machine Co.		Free Rivet & Machine Catalog tells how to save on maintenance. Completely automatic and speedy rivet setter does work of several machines.
A-10-150-2	Chicago Tool & Engineering Co.	10	Rotary, Index, Milling Table turns your drill press into a vertical miller.
A-10-171	Cincinnati Milling Machine Co.	M-1759	New Hydroform bulletin gives complete description of tooling details, operation, machine dimensions, and general specifications.
A-10-29	The Cincinnati Shaper Company	N-5	Profitable and outstandingly accurate performance. Catalog covers complete line.
A-10-31	The Cincinnati Shaper Co.	S-6&B-3	Accurate shearing and forming assured using Cincinnati Shears and Press Brakes.
A-10-197	Crucible Steel Co. of America		Unique Crucible Tool Steel Selector helps in making correct applications.
A-10-13	Erickson Tools Division		Various catalogs describe precision collet chucks, expanding mandrels, speed indexes, etc.
A-10-10	Gisholt Machine Co.		"Wear and Surface Finish" booklet tells how to reduce grinding cost and eliminate expensive hand lapping and polishing.
A-10-146-1	The J. C. Glesner Co.	A	Maximum efficiency and economy the "Glesner Way".
A-10-123	Graymills Corp.		New catalog shows selection chart. . . . tells the right pump or coolant system for the job.
A-10-182	Grinding Wheel Institute		"Standard shapes and sizes of grinding wheels" bulletin tells how to protect your investment and keep inventories low.
A-10-166-2	Grobet File Co. of America, Inc.	HC 1	Six staggered cutting edges assure a shearing cut and eliminate all chatter.
A-10-168	Hannifin Corporation	150	Bulletin tells complete story of Hannifin "Hy-Power" Hydraulics. Simple, versatile and inexpensive.
A-10-153	Hannifin Corporation	111	"Space Saver" Hydraulic Cylinders made in nine bore sizes. Superior design and construction features.
A-10-226	Haynes-Stellite Co.		For on-the-job- help write for new manual "Haynes Stellite Metal-Cutting Tools."
A-10-138	The Hisey-Wolf Machine Co.	72 EB	Free catalog tells how to overcome troubles in your drill department.
A-10-96	Honan-Crane Corp.		Free folders suggest solution of your problems—give full information about H-C engineering service for special installation.
A-10-97	The B. Jahn Mfg. Co.		Brochure gives graphic story of "B Jahn" supremacy. Costly adjustments banished!
A-10-21	The Lapointe Machine Tool Co.	DRV-5	Full information available in illustrated circular on broaching machines.
A-10-132	Lodding, Inc.		Bulletin on clamp assemblies & standard fixture components which save time & money; get quality and quick service.

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

LITERATURE NUMBER	COMPANY	BULLETIN	DESCRIPTION
A-10-218-5	Metal Carbides Corp.	50-C	More production from your present equipment with Talide tools.
A-10-146-3	The F. J. Littell Machine Co.		Catalog tells how air blast valves save time, air, dies, hands, and money—quickly installed.
A-10-103-1	W. F. Meyers Co. Inc.	13	Three good reasons given in catalog why Meyer drill jig bushings have won an enviable reputation.
A-10-193	Michigan Tool Co.	H-52	Bulletin explains new process for making more accurate unground hobs. *Lower Hobbing Costs.*
A-10-199	Miller Motor Co.	A-105 H-104	No nicks and rust, no scratch damage with hard, chrome-plated piston rods.
A-10-147	Modern Tool Works Div.	M-103	Modern-magic chuck and collet equipment eliminates costly lost time of revolving spindle machines.
A-10-107-1	Morton Machine Works		Full size templets of products sent on request bound in loose-leaf form.
A-10-160	National Broach & Machine Co.		Descriptive folder on Red Ring Gear and Spline Grinders available. Assures highest accuracy in both lead and tooth forms.
A-10-154	Norton Company	501	Alundum Tumbling abrasive finishes better, faster, at lower cost.
A-10-28	Norton Company	1632	New booklet "The ABC of Surface Grinding" more efficient surface grinding at lower cost.
A-10-192-1	Oakite Products, Inc.		Three ways to fight rust—the biggest thief in America.
A-10-223	The O K Tool Company		New catalog "Modern Milling Cutters for Modern Milling Machines" gives complete story.
A-10-99	O'Neil Irwin Mfg. Co.		"DiAcro" explains dieless duplicating with precision machines.
A-10-95	Ortman-Miller Machine Co.		Free, new catalog lists specifications, parts and other information.
A-10-196-3	J. A. Richards Co.	TE-5	"Multiform Big Brother Bender" produces without special tooling, saves die costs.
A-10-161	Rivett Lathe & Grinder Co., Inc.	105 203 400 55 303	Various catalogs offer important and necessary data for laying out successful air and hydraulic circuits.
A-10-231	Rockwell Mfg. Co.		Delta drill unit features hydraulic feed, rapid traverse, depth control, universal mounting, automatic cycling and special spindles.
A-10-117	The Sentry Company	W-4	Sentry Models YP and 2V fill requirements for high-speed steel heat-treating.
A-10-177	Scully-Jones & Co.	17-50	Bulletin gives detailed description and technical data on Roll-Lock Chucking Tools.
A-10-126	The Standard Electrical Tool Co.	44	Standard's precision grinding attachment makes your machine double-purpose.
A-10-5	Standard Gage Co., Inc.	G	Easy installation advantages at considerable saving.
A-10-233	D. A. Stuart Oil Co.		More than a "Coolant" is needed. Booklet stresses time-tested cutting fluids and lubricants.
A-10-142-2	P. A. Sturtevant Co.		Torque Manual describes permanently accurate, practically indestructible-faster-easier.
A-10-204-1	Swartz Tool Products Co.	941	Shop production tools described.
A-10-130	Tuthill Pump Co.		"Pump Guide" simplifies selection of right pumps for the job.
A-10-118	Vlier Mfg. Co.	53	Spring plungers and stops—economically priced—described in free catalog.
A-10-135	Waukesha Tool Co.		New, complete, illustrated catalog gives full specifications and prices on Waukesha Tools.
A-10-120	Wendt Sonis		Free: chip breaker chart tells how to reduce tool cost 65% on special jobs.
A-10-115	S. B. Whistler & Sons, Inc.		New, fast, proven low-cost methods assured. Price details and application illustration given.

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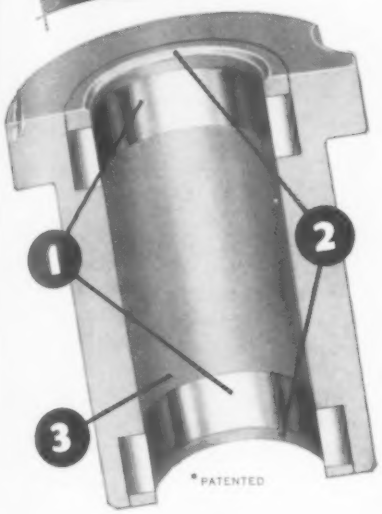

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The story is simple: MEYCO bushings last as long as solid carbide bushings in most cases at costs that come close to the prices of ordinary steel bushings. And on top of that—they will increase the life of drills and fixtures, maintain accuracy much longer and solve extra tough production drilling problems. Made to A.S.A. Standards. For full information write for catalog No. 13.

Manufacturers of precision tools since 1888

W. F. MEYERS CO., INC.
BEDFORD, INDIANA

INDICATE A-10-103-1

Rotary Table

The Kenco Mfg. Co., 5211 Telegraph Road, Los Angeles 22, has announced production of a 12-in. high precision rotary table.

This 12-in. rotary table is made of sorbocast casting for greater strength, and with 4 longitudinal T-slots for increased versatility.

The table top is graduated from 0 to 360 deg. and the dial is graduated in minutes for greater precision and closer indexing. It has an adjustable marker to aid in fast setups, and an eccentric cam which disengages the worm for high production indexing. There is an adjustable stop for positive return and to take up wear. Its accuracy is guaranteed within 0.0005 in. in concentricity run out and 0.0001 in. in parallel top to base.

The table has a 7¾ in. diameter hold-down ring for added rigidity. All working parts are completely enclosed to protect them against grit, dust and dirt, insuring added life and trouble-free precision operation. **T-10-1031**

Hand Bar Speed Knob

The Jergens Tool Specialty Co., 712 E. 163rd St., Cleveland, has announced the addition of hand bar speed knobs to their line.

According to the manufacturer, the speed knobs are constructed with four metal prongs to provide greater tightening and clamping action by simply inserting a spanner or wrench handle

between the prongs. The speed knobs are made of malleable iron castings and are available from stock in a wide range of sizes in blanks, drilled and reamed or drilled and tapped. They are designed to replace standard knobs and handwheels for extra clamping action on dies, jigs and fixtures. **T-10-1032**

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The Reamer Specialists

LAVALLEE & IDE, INC.
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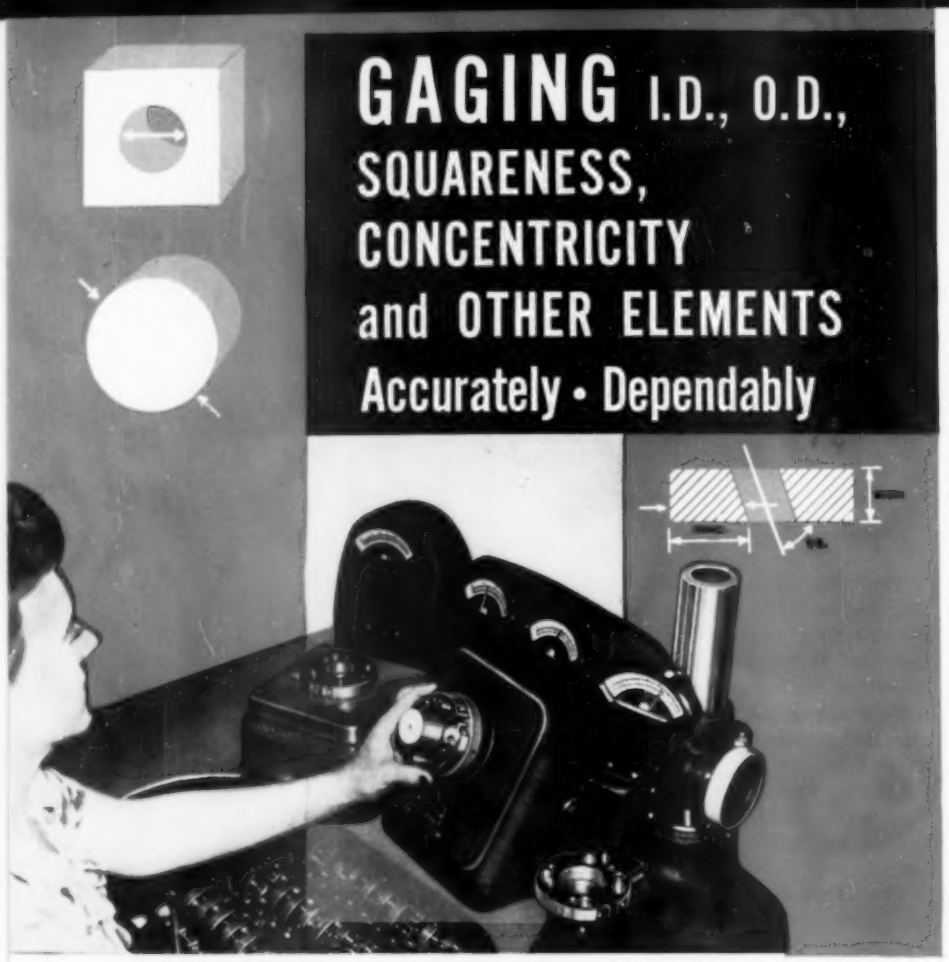
INDICATE A-10-103-2



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Scale Removal

The Elmes automatic billet descaling cabinet is a unit with a removable scale basket. It is equipped with gravity conveyor head, is fully automatic in operation, and is available in both pit-mounted and floor-mounted types. The spray ring is fitted with six spray nozzles which completely encircle the billet.

The nozzles are directed at both ends of the billet so as to completely remove scale at both ends. The roller conveyor is arranged to withstand extreme temperatures. Spray nozzles are readily accessible for replacement when necessary. The unit is all welded steel construction with rust-proof screening in the scale basket. The descaling cabinet can be supplied complete with necessary operating controls for use with existing accumulator system, or with suitable accumulator system and pumps. For further details write American Steel Foundries, Elmes Engineering Div., 1186 Tennessee Ave., Cincinnati 29.

T-10-1041

Drilling Machine

A machine which drills seven holes at once and insures the proper location of the holes in the pieces being drilled has recently been announced by the Govro-Nelson Co., 1933 Antoinette, Detroit 8.

Incorporating six Model KH Govro-Nelson self-contained automatic drilling units, the machine drills five radial holes and two parallel holes simultaneously in an aluminum part. Output rate: 500 parts per hour, or 3500 holes per hour.

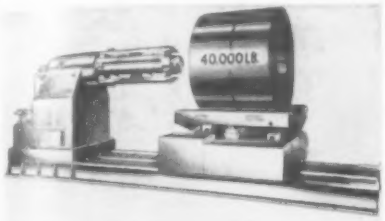
In operation, the operator loads the part and touches the start button, whereupon the part is automatically clamped, drilled and unclamped.

By varying the position of the units, the machine can readily be adapted to other drilling operations.

T-10-1042

Centering Reels

Now being produced by F. J. Littell Machine Co., 4199 Ravenswood Ave., Chicago 13 are extra heavy duty automatic centering reels in 5, 10 and 20 ton capacities.

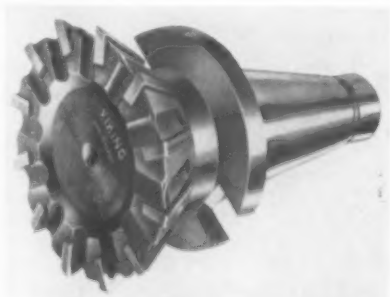


These reels have hydraulically expanded arms which are contracted and expanded by means of hydraulic actuated cams within the spindle. As the spindle sleeve is hydraulically pushed forward, the arms contract to the minimum diameter. As sleeve is pulled toward the frame, the arms spread until the coil is gripped tightly. The cams on the sleeve and on the arms are mechanically interlocked to hold arms in position, both expanded and contracted. The simultaneous expansion of the arms perfectly centers the coil.

The V-type coil-loading car rides on a smooth running track base. The track can be extended from machine to coil storage area, hence material can be conveyed to reel without intermediate handling. **T-10-1051**

Dovetail Cutters

The Viking Tool Co. of Shelton, Conn., has added to its line of inserted tooth milling cutters, an inserted tooth dove-tail milling cutter. These cutters will feature the Viking dual thread screw and wedge lock incorporated in the other milling cutters manufactured by this company.



The cutter bodies and blades have mating serrations to provide positive blade positioning and dual blade adjustment. The cutters will be offered with either high speed steel, cast alloy, or carbide replaceable blades; and in shell or integral shank type. **T-10-1052**

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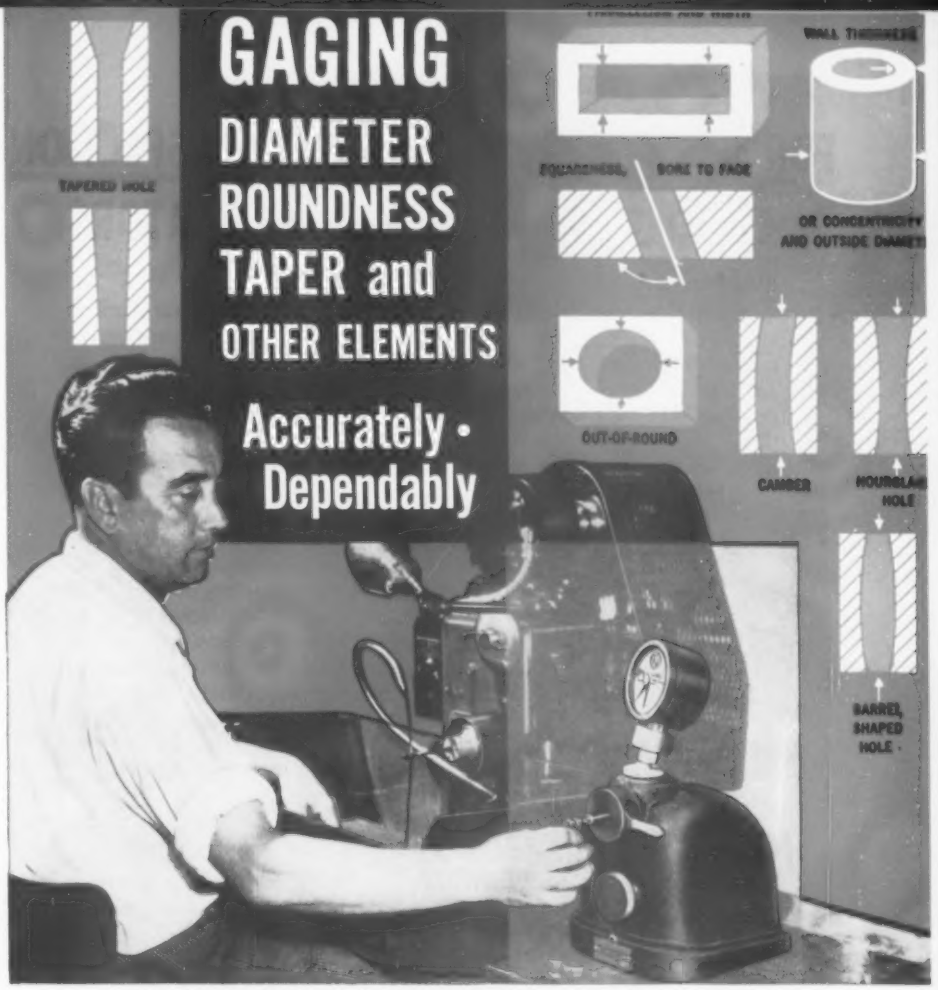

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A wide range of internal and external sizes and shapes can be tested rapidly and dependably to an extremely high degree of accuracy.

Pratt & Whitney Air-O-Limit Gages can reduce inspection costs and improve quality control in your plant. For complete information on this faster, better gaging method, send today for Bulletin No. 524-1. Write on your Company letterhead to the P&W Branch Office nearest you—or direct to West Hartford.

Bulletin 524-1

PRATT & WHITNEY
DIVISION NILES-BEMENT-POND COMPANY
WEST HARTFORD 1, CONNECTICUT, U. S. A.

First Choice for Accuracy

BRANCH OFFICES AND STOCK . . . BIRMINGHAM* • BOSTON • CHICAGO
CINCINNATI • CLEVELAND • DALLAS (The Stanco Co.) • DETROIT • LOS ANGELES
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CUTTING TOOLS • GAGES • MACHINE TOOLS

*OFFICE ONLY

FOR *Strictly* IMPERSONAL INSPECTION CHOOSE AMES DIAL COMPARATORS

Ames Dial Comparators make the inspection of duplicate parts an extremely simple, rapid and accurate operation. Ames Comparators are strictly impersonal in their accuracy — the results being in no way dependent on the skill or judgment of the operator. The pressure of the gauging members against the work is mechanically determined and therefore uniform.

Check the Ames Dial Comparators shown — one of them may solve a Quality Control problem for you.

Ames No. 1 Dial Comparator is an easily adjustable bench model that measures objects up to 2" in cross section. The table bracket may be quickly located and locked in position on the column. The table itself may be further positioned and locked for final fine adjustment. This comparator is designated *Ames No. 1W* when equipped with dead-weight contact pressure and contact area to ASTM specifications for measuring resilient materials, such as rubber, plastics, etc.

Ames No. 2 Dial Comparator is a compact, stable bench model for measuring non-yielding materials — sheet metal, glass, hard rubber. The 2" diameter table is adjustable to bring pointer to zero. *Ames No. 2W* is similar to the Ames No. 2, but is furnished with dead-weight contact pressure and contact areas to ASTM specifications for checking textiles, plastics, sheet rubber, etc.

Ames No. 13 Dial Comparator features flat-ground, cast-iron base of ample size for using V-blocks and locating fixtures for checking rounds, flats and odd shapes. Also, the No. 13 can be fitted with a fine adjustment for close setting. Accurately adjustable bracket holds any Ames Micrometer Dial Indicator.

Ames No. 130 Dial Comparator is designed especially for inspecting comparatively large parts. For this reason, the flat-ground steel base, the adjustable indicator support on which can be mounted any Ames Micrometer Dial Indicator, and the upright column are proportioned to suit the user's particular requirements.

Send us your Quality Control job specifications, and we will supply complete details and proposal without obligation.

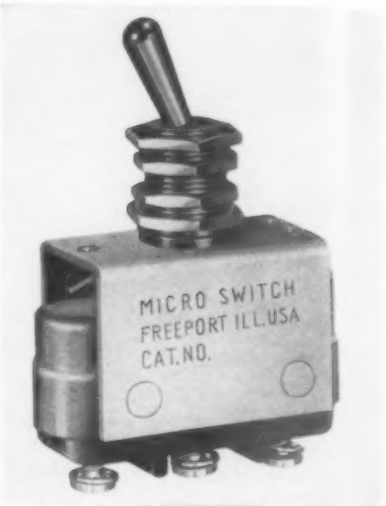
Representatives in principal cities. B. C. AMES CO. *80 Ames Street, Waltham 54, Mass.*

Mfgr. of Micrometer Dial Gauges • Micrometer Dial Indicators

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-106

Toggle Switch

A hermetically sealed precision toggle switch whose performance and operating characteristics are unaffected by environmental conditions has been developed by the Micro division of Minneapolis-Honeywell Regulator Co., Freeport, Ill.



The switch can be used in a wide variety of installations for which other switches are unsuitable. It will deliver its full electrical rating and operating characteristics without regard to changes in atmospheric pressure or temperature, and will not be affected by the presence of corrosive atmosphere, dust, dirt, oil or water, it is claimed. Its vapor-proof character prevents condensation on switch contacts.

Mechanical life tests indicate the switch has a life expectancy far greater than the 25,000 operations normally anticipated for hand-operated switches. The toggle mechanism provides a detent for both on and off position. The basic switch has a single-pole, double-throw contact arrangement.

Tentative electrical rating for the switch is given conservatively as follows: 5 amperes motor load 30 volts dc; 10 amperes inductive load 30 volts dc; 25 amperes resistive load 30 volts dc; 1.0 ampere ac for any type of load. 25 volts ac. **T-10-1061**

Tiny Grinding Wheel

Only $\frac{1}{8}$ in. in diameter, these miniature mounted wheels are used for grinding extremely small holes in miniature bearings, bushings, instruments, and for similar precision applications. Exact duplication of even the most minute parts is possible with this new development in the abrasive field. Additional information may be obtained by writing to the Chicago Wheel and Mfg. Co., 1101 West Monroe St., Chicago 7.

T-10-1062

Ratchet-Lever Hoist

The model R coil-chain ratchet-lever hoist, now in production at Coffing Hoist Co., 800 Walker St., Danville, Ill., introduces many convenience and safety features, according to the manufacturer. The model R retains the ratchet and pawl operating principle which eliminates the necessity of a friction brake. The load is suspended on the ratchet and pawl at all times, thus cannot slip, nor will the holding mechanism freeze.

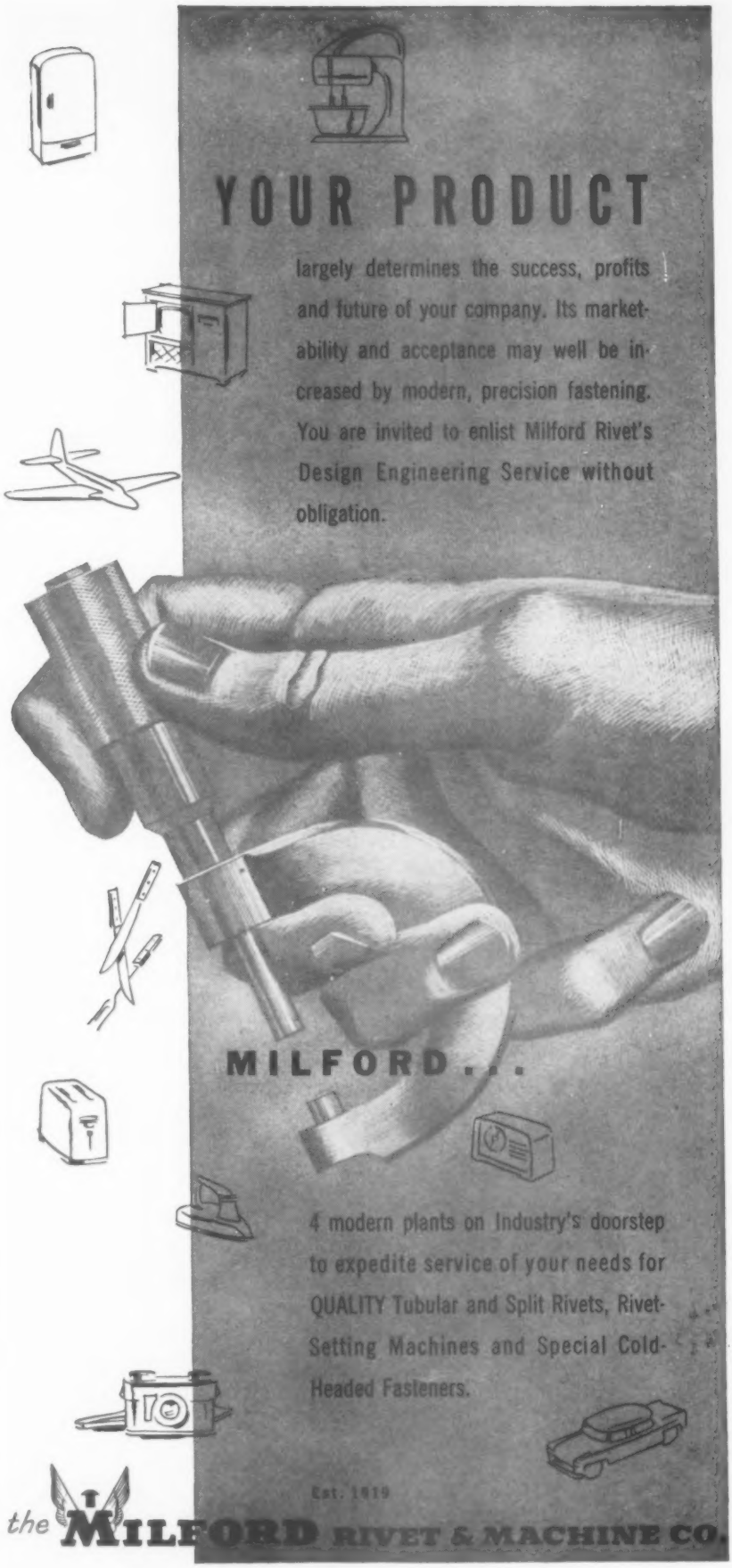
Use of coil instead of roller chain in the model R is said to permit the chain to swing or wrap easily in any direction. When not under load, it may be pulled freely through the hoist head for quick adjustment. The handle operates in any position, and can be operated with either partial or full strokes, depending upon space limitations and desire of the operator. Safety stops prevent spinning of the handle.

The hoist has but few parts, and can be completely disassembled in a short time with only a screwdriver. The unit is available in 1,500 and 3,000-lb. capacities. **T-10-1071**

Turret Lathe

This bench turret lathe is designed to handle very small parts. It is made with two collet capacities, 3/16 or 5/16 in. It is equipped with a lever operated collet closer, a double tool cross slide with a swivel compound slide, and a self indexing, six in. position turret. The bed is 18 in. long.

The turret head has holes ½ in. in diameter. The turret slide is made of hardened steel for accuracy and long wear. This small turret lathe is described in a bulletin which may be had by writing to Louis Levin & Son, Inc., 782 East Pico Blvd., Los Angeles 21. **T-10-1072**


YOUR PRODUCT
largely determines the success, profits and future of your company. Its marketability and acceptance may well be increased by modern, precision fastening. You are invited to enlist Milford Rivet's Design Engineering Service without obligation.
MILFORD...
4 modern plants on Industry's doorstep to expedite service of your needs for QUALITY Tubular and Split Rivets, Rivet-Setting Machines and Special Cold-Headed Fasteners.
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867 Bridgeport Ave., MILFORD, CONN. 818 Illinois Ave., AURORA, ILL.
1118 W. River St., ELYRIA, O. 38 Platt St., HATBORO, PA.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-107

Here's Why the New TOP-CLAMP KENNAMATICS Give Top Performance

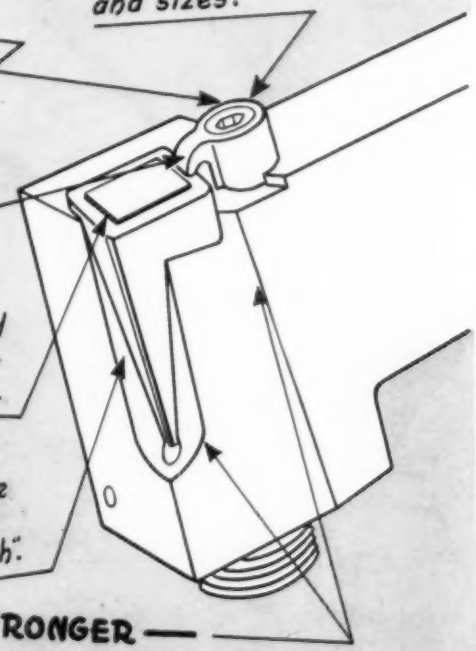
EASY TO GET AT— double end socket type screw permits release of clamp from either top or bottom.

SIMPLIFIED DESIGN— one rugged clamp and one sturdy screw for all standard tool styles and sizes.

EASIER TO INDEX— simply loosen clamping screw and clamp is up and away from insert.

CHIP BREAKER — most types can be used on insert without interference with clamp.

OPEN FRONT — provides added clearance and eliminates shank abrasion from "chip wash".

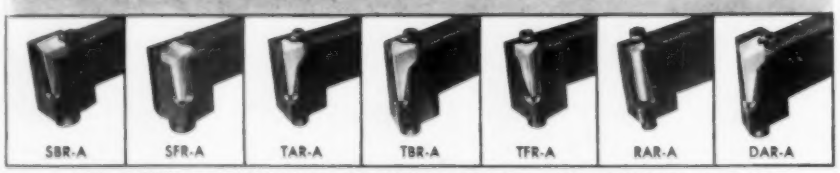


STRONGER — design provides greater rigidity. Insert is solidly backed up in direction of cutting force.

ALL Proved KENNAMATIC Features Retained!

- Indexable insert—positioned vertically—makes best use of Kennametal's high compressive strength.
- Simplified tool setting—insert has several cutting edges on both ends; can be revolved, turned end over end, or replaced without changing tool setting.
- Less grinding expense—resharpening merely requires squaring off ends of insert, and grinding chip breaker if desired.
- Available in all "industry standards" for wide range of jobs on various metals. Heavy duty styles also available.

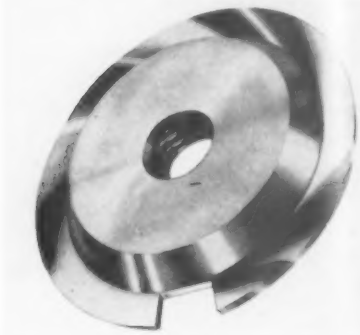
KENNAMETAL Inc., LATROBE, PA., U. S. A.



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-108

Carbide Cut-Off Tool

Gay-Lee Co., Clawson, Mich., announces that they have been licensed to manufacture and sell a standard solid carbide cut-off tool for Brown and Sharpe automatic screw machines.



The tool provides for strong support of the solid carbide blade. The steel hub and carbide blade are brazed to form a single permanently bonded unit. The method of holding the carbide assures complete support and minimizes carbide breakage and parting from the hub, a problem with most designs.

A second feature of the cut-off tool is the grind. It is gashed to provide two cutting edges. This permits cutting off with the top of the work coming or going. Ten standard sizes are stocked. Each is designed for any size bar stock up to the normal capacity of the machine. **T-10-1081**

Pyrometer-Voltmeter

Designed for portability to the job and with a high degree of accuracy, a combination temperature-indicating pyrometer and millivoltmeter has been announced by Thermo Electric Mfg. Co., 480 Huff St., Dubuque, Iowa.

Long thermocouple leads permit temperature checkings up to eight feet from the instrument and in places not readily accessible. The pyrometer scale is 3¾ in. long and mirrored for accurate, easy reading. Three scale ranges are available, all calibrated in Fahrenheit, Centigrade and millivolts, as follows: 800 deg F—430 deg c—17 mv.; 1600 deg F—865 deg C—36 mv.; 2250 deg F—1225 deg C—50 mv. Automatic compensation for internal resistance changes due to variation in ambient temperature is provided. Accuracy is well within one percent.

The instrument is housed in a carrying case with a removable hinged cover and a compartment for storing the thermocouple and lead wires. **T-10-1082**

USE READER SERVICE CARD ON PAGE 101 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Hook-on Volt-Ammeter

A redesigned hook-on volt-ammeter with higher voltage and current ranges and a new pointer-stop mechanism has been announced by the Meter and Instrument Department of the General Electric Co.

Designated type AK-1A, the new instrument will measure alternating current instantaneously on five scale ranges—0-7.5/30/75/300/750 amperes. It can be used on both insulated and non-insulated conductors by simply hooking it around the power line. No separate transformers or additional equipment is required.

The instrument will also measure ac voltage on three ranges: 0-150/300/700 volts. To use these ranges, the terminals are connected to the line, and a positive-action selector switch is turned to the desired scale.

The pointer-stop mechanism permits the user to quickly determine peaks in motor starting currents.

A dovetail joint on the instrument's magnetic jaws reduces errors caused by imperfect closing to less than two per cent where ordinary butt joint might cause errors as high as 10 per cent.

The hook-on portion of the AK-1A is a split core transformer with its secondary winding tapped for different ratings and connected to a rectifier instrument through a range-changing selector switch. When the switch is thrown to any voltage-range position, the rectifier is connected to the binding posts through proper internal resistors. Voltage may be measured by connecting leads to the binding posts on the front of the instrument.

The instrument is shielded magnetically. Five hundred amperes in a conductor one foot away from the transformer causes negligible effect on the 300 and 750-ampere ranges, and less than one per cent error on 7.5-, 30-, and 75-ampere ranges. **T-10-1091**

GET DUMORE

the drill head with automatic built-in controls

Self-Contained Air
No cumbersome air lines to hook up. Simply plug into electrical outlet. Built-in rotary air compressor advances drill at *required* speed and feed for *new resistance drilling.*

New Resistance Drilling
Provides completely automatic operation. Self-compensating control of drill by combined action of Air Feed Pressure Regulator and built-in return spring allows material being drilled to govern rate of drill feed and speed.

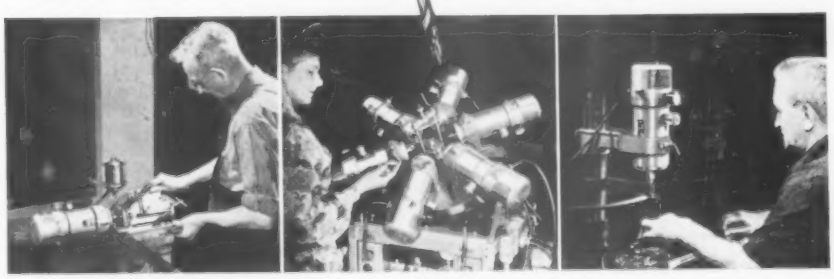
Adjustable Stroke Control
Select depth of stroke by adjustable stop nuts. Allows *measured depth* drilling from 1/32" to 1-1/8". Can be controlled to .004" preciseness.

Air Feed Pressure Regulator
Permits adjustment of pressure up to 15 P.S.I. Allows for variation in drill size. This simple control governs rate of drill advancement in work.

Automatic Chip Clearance
Depth Staging feature provides retraction of drill at proper intervals for chip clearance. Prevents drill breakthrough, practically eliminates costly drill breakage.

Maximum Drilling Production
Automatic operation of drill allows free use of operator's hands. Fast, one-time setup makes this machine ideal for simultaneous operations.

and get all these cost reducing benefits



Motor manufacturer doubled output on armature shaft drilling. Decreased drill breakage 25 times.

Unusual setup drills bronze nozzle holders. Labor costs slashed $75 on first run of 5273 pieces.

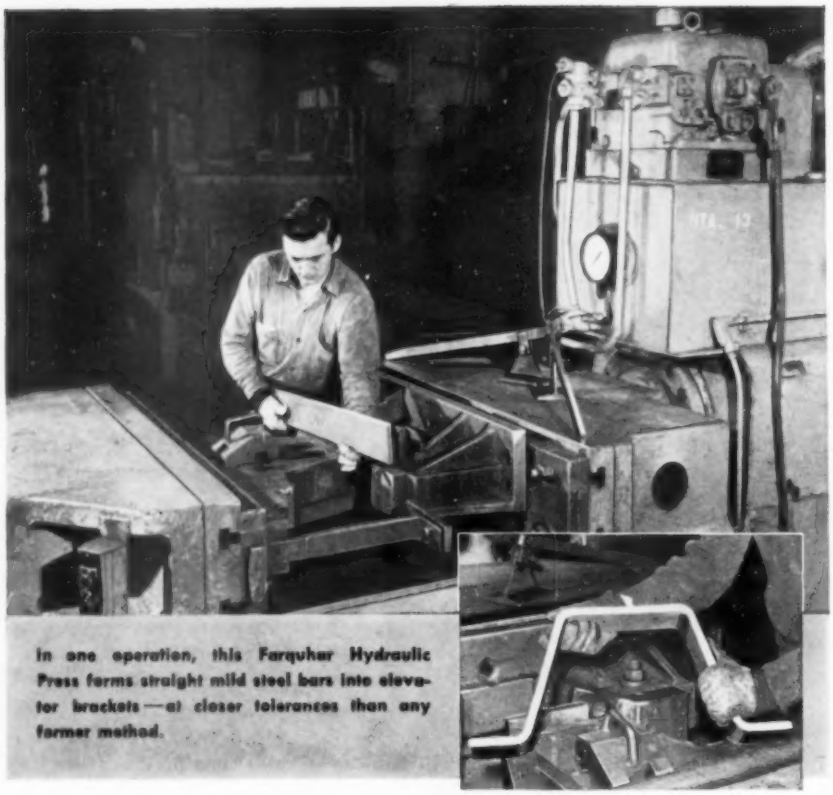
Sound equipment manufacturer cashed in on big savings. Cut drill breakage to the bone.

WITH the Dumore automatic drill head, you can say goodbye to excessive drill breakage, down time and scrap loss on small diameter, deep hole drilling. And just as important, you *increase* drilling capacity.

Get all the information about this revolutionary tool. Ask for demonstration. See how it eliminates operator guesswork and provides completely automatic control, flexibility of setup, big cost reductions at desirably low cost.

Call your distributor today, or write for bulletin.

THE DUMORE COMPANY
1325 Seventeenth Street • Racine, Wisconsin
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-109



In one operation, this Farquhar Hydraulic Press forms straight mild steel bars into elevator brackets—at closer tolerances than any former method.

OTIS ELEVATOR COMPANY *boosts production, slashes time and labor costs in half, with this*

FARQUHAR HYDRAULIC PRESS

In forming lengths of mild steel, the Otis Elevator Company, world's largest elevator and escalator manufacturer, would heat steel and bend it while it was hot. Trying to improve on this system, Otis Production Engineers developed a cold bending process. Farquhar Engineers were contacted, and a 250 Ton "Bulldozer" Horizontal Press was recommended and installed. By bending the steel bars cold in the Bulldozer, Otis has effected a 50% increase in production alone! Time and labor costs have been reduced an estimated 33⅓%! In addition, the Bulldozer operates at closer tolerances than the old heat and bend method. All this, 8 hours a day, 5 days a week, with maintenance costs that Otis terms "negligible."

Farquhar Presses Cut Your Costs

Just one more example of cost-cutting Farquhar performance in heavy production! Farquhar Presses are built for the job . . . assure faster production due to rapid advance and return of the ram . . . greater accuracy because of the extra guides on the moving platen . . . easy, smooth operation with finger-tip controls . . . longer life due to positive control of speed and pressure on the die . . . long, dependable service with minimum maintenance cost!

Farquhar engineers are ready to help solve whatever production problem you may have. Your request will bring them running . . . at no obligation, of course.

Send for free catalog showing Farquhar Hydraulic Presses in all sizes and capacities for all types of industries. Write to: A. B. FARQUHAR Co., Hydraulic Press Department, 1519 Duke St., York, Pa.

Farquhar

HYDRAULIC PRESSES

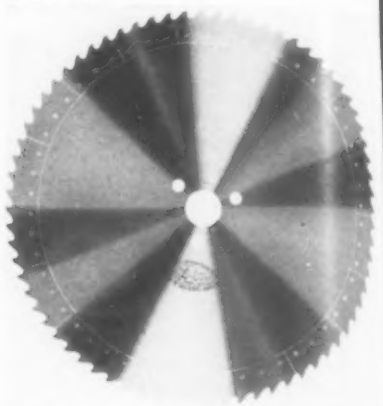
for Bending • Forming • Forcing • Straightening • Assembling • Drawing
Extruding • Jogging • Forging • and other Metalworking Operations

A. B. FARQUHAR COMPANY Division of THE OLIVER CORPORATION

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-110

Circular Saw

A segmental circular metal-cutting saw with up to 30 per cent more productive life has been announced by Henry Disston & Sons, Inc., Philadelphia, Pa.



Called the Disston Chromos, the saw features segments which are locked together by flexible tightening pins instead of rivets. This patented design insures perfect alignment of the segments around the entire cutting edge, and gives longer life to the saw because there are no aligning rivets to limit sharpening. It also makes possible replacement and automatic alignment of segments.

These saws are available in diameters from 11 to 63 inches and with various tooth spacings for cutting any ferrous or non-ferrous metals. Center holes are custom drilled on order for perfect fit.

T-10-1101

Pneumatic Mechanism

A pneumatic closing mechanism for power circuit breakers is more powerful than a solenoid mechanism and provides the increased energy required in the quick closing and reclosing of circuit breakers of high interrupting capacity.

Two sizes of mechanism are available: the type AA-7 and the AA-10 with 7- and 10-inch pistons respectively. These two mechanisms are used for closing breakers ranging from 14.4 kv, 500,000 kva through 230 kv, 15,000,000 kva.

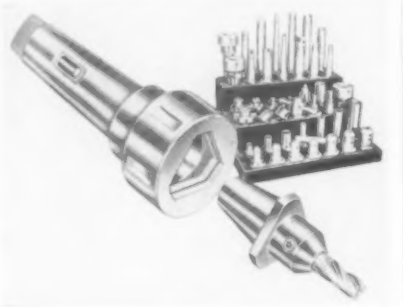
The mechanism is mechanically and electrically trip-free, compressed air cannot hold the breaker closed when the trip coil is energized. High speed reclosing in 20 cycles, ultra-high speed reclosing in 15 cycles or less, or multiple high-speed reclosing is possible.

The mechanism is factory adjusted and all parts are located for easy access. The air compressor is driven by a single-phase motor and can charge the reservoir tank with enough air for five operations.

For further information, write Westinghouse Electric Corp., P.O. Box 2099, Pittsburgh 30. **T-10-1102**

Tool Holder and Adaptor

A simple lock P D Q (Portage Double Quick) tool holder with a locking feature that permits faster tool changes and assures constant repositioning is announced by the Portage Double-Quick Tool Co., 1054 Sweitzer Ave., Akron, Ohio. Three-point holding of the taper shank design eliminates run-out on precision work. The 57-piece tool set includes holders for boring, milling, and lathe applications.



Boring mill holders are Nos. 4, 5, and 6 Morse taper and Nos. 40 and 50 taper for milling machines. Turret lathe adaptors are designed to fit any turret lathe. End mill adaptors range in size from ⅜ up to 1¼ in. The boring bar holder has straight or 30-degree angle bit, measures 3, 6, 9 and 12 in. in length. The boring head has accurate micrometer adjustment. Also included in the set are adaptors for shell mills, end mills, drill chucks, and boring heads. **T-10-1111**

Solenoid Valve

Designed for a wide range of industrial applications, the Model 67 solenoid valve manufactured by A-P Controls Corp., 2402 N. 32nd St., Milwaukee 45, Wis., is offered in two body styles and with two types of needle and seat construction.

Where positive seal-off is required, the valve is furnished with a synthetic resilient disk-type needle, seating against a stainless-steel orifice. This provides bubble-tight operation under severe conditions. For other applications, the valve is furnished with a stainless-steel needle, in combination with a high-strength, corrosion-resistant stainless-steel valve seat.

Available in two body styles, ⅜ in. female pipe or ½ in. O D tube sweat connections, the valve can be used for air, oil, water, gasoline, alcohol, detergents, refrigerants, butane, propane or other noncorrosive liquids and gases. Capacity on water is 78 gph and on refrigerant applications, one ton of Freon 12. Working pressure is up to 300 psi. Operating differential: liquid lift up to 130 psi, air and gases 250 psi, refrigerants 200 psi. **T-10-1112**

Production News

ABOUT *Lusol*.. —THE ALL-CHEMICAL METAL-WORKING SOLUTION

FROM F. E. ANDERSON OIL COMPANY • PORTLAND, CONNECTICUT

Tired of being a coolant guinea pig?

"Where has Lusol been all my life?" exclaims many an enthusiastic user, on discovering Lusol for the first time. "Is it new?" Let's see how long-time users answer this:

A sales manager on grinding wheels

"I knew about Lusol over three years ago, before I moved into this territory. Keeps wheels open so that, when we run into grinding trouble, we often recommend a switch to Lusol. It has pulled us out of many a hole."

A maker of steel and brass valves

"Well over three years ago we adopted Lusol for almost all of our machining and grinding work. It speeded up every operation. Its use saved us thousands of dollars last year alone, because of the cleanliness of Lusol. No antislip grit is needed on the floors, and the men and machines stay clean."

A manufacturer of tool chucks

"Been using Lusol for over two years on Gisholts, Blanchards, Bullard Multimatics, drills; in fact, on all conventional machining operations. Lusol is easy to mix and clean to work with. No dermatitis. Doesn't gum up the machines. The solution is clear, so grinder operators can see what kind of finish they are getting."

Foreman of a drilling department

"For four years we've had 30 to 40 girls working with Lusol on small drills. No skin trouble. The advantage of Lusol is that, on these small holes, the girls can see the drills more clearly."

An operator on a Warner & Swasey lathe

"I learned of Lusol over three years ago from my brother who works for another company, so I asked for it. Now we use Lusol for cutoff saws, drilling and milling, as well as in our Warner & Swasey lathes. No more skin troubles. The machines are clean and cutting tools last a hundred times longer."

Such are the performance reports told to us firsthand by Lusol users everywhere. Lusol is *old enough* to have proved itself . . . *young enough* to have continued to improve as developments warranted.

FREE BOOK

Get complete facts about Lusol by writing for this 20-page booklet. It contains information on machine cleaning, maintenance of Lusol solutions, elimination of dermatitis and odor in machines, plus many case histories of Lusol at work. Write F. E. Anderson Oil Company, 213-E, Portland, Conn.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-111

Chicago
MOUNTED
Wheels
They're the Best

...now
even better
with

79E BOND

the new miracle grinding wheel bond

Choose Chicago Mounted Wheels — bonded with 79E Bond — and you'll never buy any other! This tough new grinding wheel bond, exclusive with Chicago Wheel, has taken the industrial world virtually by storm, doing a better grinding, burring and finishing job faster. Greatest selection of sizes and shapes for every application. Best of all, deliveries are good . . . ready when you need them. Try 79E Bond Mounted Wheels.

WRITE today for full information and literature. It's free.

CHICAGO WHEEL
& Mfg. Co.
Dept. TE • 1101 West Monroe Street
Chicago 7, Illinois

OFFICES IN PRINCIPAL INDUSTRIAL CENTERS
INDICATE A-10-112-1

Gage Blocks

A carbide gage block with unusual characteristics is introduced by Webber Gage Co., Cleveland, under the trade name of Croblox.

It differs from other carbide blocks in the type of alloy from which it is made. The alloy is chrome carbide. It gives the block superior corrosion resistance, plus a remarkable similarity to steel in the coeficient of expansion. Heretofore, critical measurements with carbide blocks had to be corrected to take into account this difference of expansion between itself and steel. This was particularly necessary when working with tolerances in split tenths.

Croblox expanding in nearly the same degree as steel makes it easier to use. Room temperature variations can be ignored. Furthermore, the care bestowed on other blocks to protect them from corrosion is no longer necessary. The blocks can be exposed to a wide range of atmospheric changes without a trace of rust. **T-10-1121**

Thread Roller

The Reed thread rolling attachment, series G2A, permits threading close to shoulders, and since rolling can be done on the collet end of the part behind shoulders, a secondary operation is often eliminated.

This attachment is of the geared type, and is currently built in three standard sizes, ½, ¾, and 1 in. Each size accommodates an infinite range of work within the capacity of the attachment. Other special sizes are available on larger threads.

These attachments incorporate a simple means for readily changing thread rolls and adjusting them for size. A precision matching device permits the rolls to be accurately matched by rotating one roll in relation to the other in infinite increments of circular measurements.

The head pivots in the adapter allowing the rolls to automatically position themselves in relation to the center line of the spindle on contact with the work. Clearance between the shank of the head and the adapter allows the head to float sidewise which eases the side pressure on the rolls as they are fed into the work. Upon completion of rolling, the head returns to the centralized axial position in the adapter.

For further information, write to Reed Rolled Thread Die Co., 237 Chandler St., Worcester 2, Mass. **T-10-1122**

USE READER SERVICE CARD ON PAGE 101 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Are you interested in saving up to 50% in your inspection time, also extending for many years the useful life of expensive gage blocks?

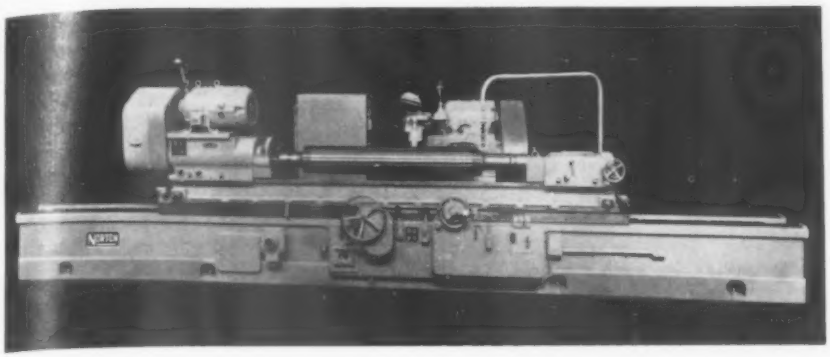
The above is being accomplished in many of the largest manufacturing companies in the country by the use of the Pioneer Tool gage block jack.

Designers and manufacturers of tools, dies, gages, fixtures, special machines, optical checking equipment and precision instrumentation parts.

PTE Co

PIONEER TOOL & ENG. CO.
3914-18 W. Shakespeare Ave.
Chicago 47, Illinois
INDICATE A-10-112-2

Cylindrical Grinding Machine



A new heavy duty Norton type C-2 cylindrical grinder built as a plain or semiautomatic machine in 18, 24, or 30 in. swing, and in work lengths of 48, 72, 96, 120, 144, or 168 in., is now available for grinding large cylindrical work. In addition to a fast grinding action, the type C-2 offers features that reduce costs by simplifying setup and operation, and by requiring less maintenance.

With this machine, setups are quickly made because all controls for feeds and speeds are adjusted at the front of the machine in the operating position. Actual operation of the type C-2 is considerably simplified by several important features. One of these is the combination graduated wheel feed handwheel and click-count indexing mechanism which indicates the amount of feed as the wheel is rotated past a fixed pointer, and permits settings of 0.0001 in. on work diameter instantly and without visual attention.

Further operating ease is provided by the pre-set truing and grinding speed arrangement. With this feature, table speeds for truing and grinding are independently adjustable and preset, and either speed is immediately obtained when desired, by movement of a combination selector and table start-stop lever. No resetting of these speeds is necessary in the change from one to the other. Work-jogging control by means of a lever conveniently located near the operating position is also provided.

Additional operating ease comes from automatic or manual control of work rotation and coolant flow, and automatic adjustable wheel feed at table reversals with automatic resetting of the wheel head. Separate dwell controls for each end of table reversal are also provided. Table action is extremely smooth through a wide speed range which provides the best rates for truing, for obtaining fine finish, or for production.

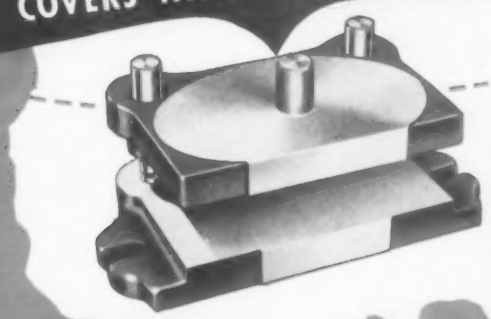
To simplify and speed maintenance functions, all pumps and motors are placed in accessible locations outside of the machine. Filters, relief valves, ways lubricant flow control valves, and all oil reservoirs are also on the outside. Electrical controls are grouped in an elevated enclosure for protection and for maximum convenience in inspection. Other advantages are a large capacity low-wall coolant tank that has a ramped outlet for easy clean-out, and a hinged wheel guard cover for easy wheel change. The base ways are protected by space-saving, steel tape-type guards.

The wheel spindle unit houses pressure-lubricated bearings which enclose over 50 percent of the wheel spindle body to provide exceptional rigidity. With its minute oil clearance requirements, this unit is equally efficient for the finest finishing operations or for heavy stock removal jobs without any bearing or oil pressure adjustment.

The type C-2 semiautomatic machine provides all of the foregoing advantages and in addition, its grinding cycle operates with one-lever control. When operating on the electrically-timed cycle, the operator need only load the machine, touch a control lever, and the machine will go through its cycle automatically.

T-10-1131

DETROIT DIE SET SERVICE COVERS INDUSTRIAL AMERICA



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Your "Detroit" Die Set man knows die sets. Call him in . . . talk over your die set problems with him. Get from him full facts about the accuracy of "Detroit" parallel surfaces, the trueness of pins, the fine finish, the thorough inspection at the factory. You'll see that "Detroit" leaves nothing undone to assure easier mounting and longer production runs. Call your "Detroit" man.

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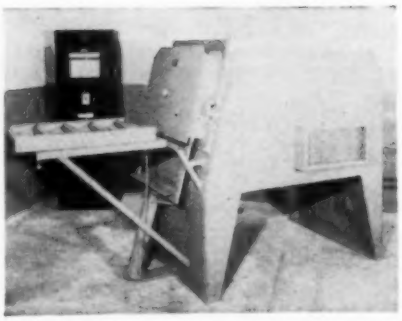
DETROIT DIE SET ★

FOR FURTHER INFORMATION, USE READER SERVICE CARD, INDICATE A-10-113

Tempering Unit

A unit that makes possible both bright, scale-free tempering, and controlled oxidation tempering from 400 to 1400 deg. F has been announced by Ipsen Industries, 715 S. Main St., Rockford, Ill. Known as the Ipsen D-300 tempering unit, the sealed, controlled atmosphere furnace utilizes a new process of controlled oxidation developed recently by the Ipsen research staff.

In past years, bright or controlled oxidation tempering was not important, inasmuch as a heavier scale had already been formed on the piece at higher temperatures during the heat treating cycle, and a cleaning or pickling operation would be necessary. However, with the development of bright, scale-free heat treating, considerable time and expense could be saved with bright or controlled oxidation tempering, eliminating cleaning operations.



For bright tempering, the tempering unit is supplied during the entire cycle with a protective atmosphere. After sufficient time at temperature, the load is cooled in the furnace until it reaches approximately 400 deg. F. The bright scale-free work is then cool enough to be removed from the furnace without danger of oxidation. The finish remains clean, bright, and scale-free, and no cleaning or pickling operations are necessary before subsequent plating or painting.

The unit also readily produces a controlled oxide coating, which is often desired to reduce corrosion or wear, and to produce an attractive blue-gray or blue-black appearance. This is accomplished either in a separate operation or concurrently with a tempering or annealing operation.

The protective atmosphere is used to maintain a bright surface during any necessary tempering or annealing operations prior to the controlled oxidation cycle. It is therefore possible with the Ipsen D-300 to maintain strict control over the oxidation process irrespective of the tempering or annealing portions of the cycle.

After the load heats or cools to the oxidation temperature the flow of protective gas in discontinued and a predetermined quantity of water is introduced into the unit for a specified period. The work is then removed from the furnace and air-cooled or liquid quenched.

During either air or quench cooling, further oxidation is prevented by the controlled oxide coating. The air-cooling produces a blue-gray coating, and the oil quench forms a darker blue-black finish, due to the penetration of oil into the oxide film. This darker coating is more attractive and is considerably more resistant to corrosion. Either soluble oil or standard quenching oil may be used. **T-10-1141**

Chemical Cleaner

A compound which completely removes occluded salts with one rinse after the black oxidizing of metals has been developed by the Du-Lite Chemical Corp., Middletown, Conn.

Known as Du-Lite SD, this liquid compound reacts chemically on black oxide salts which often remain trapped in rough or irregular surfaces of porous, laminated, sintered or spot welded parts. If used as recommended in a bath of from 225 to 275 deg. F, a visible boiling results from the chemical action until all salts are removed. However, the reaction does not break down the compound, which can be re-used.

SD was specifically developed to overcome creeping salts which previously have required numerous hot and cold rinses for their removal and made the black oxidizing of laminated metals impractical. Exhaustive humidity testing of parts treated with SD produced no trace of occluded salts nor of rust, which the light coating left by the compound also prevents.

T-10-1142

5 tips serve every machine in your plant!

There is no need to stock all the various sizes of Morse, Browne & Sharpe, or Jarno taper centers when the INTOCO line of adapter shanks and 5 sizes of insert tips will do the job.

The INTOCO line of lathe and grinder centers is the result of extensive research and engineering. Centers are of two piece design, consisting of a shank and replaceable tip. INTOCO Center Tips are made in four different alloys to fit the many different applications that the modern shop is called upon to machine.

INTOCO Tips are ground to a fine tolerance and finish, and perfect concentricity is maintained between the O.D. of the shank and the center point.

Learn more about the INTOCO line and how it can increase shop production and save you time and money. Don't delay – write today for free 8 page catalog which gives complete specifications on INTOCO Standard and Gash Type Center Tips.

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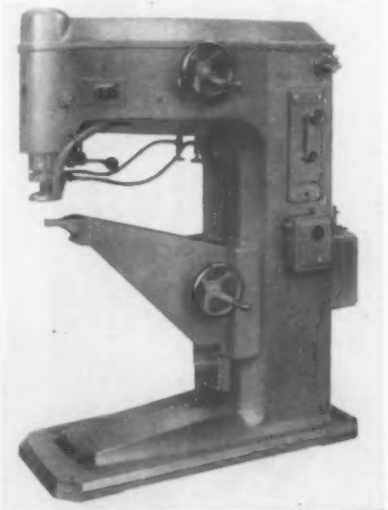
USE READER SERVICE CARD ON PAGE 101 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Horn Router

Useful for many types of trim routing operations in nonferrous metals requiring an unusually large swing clearance, the Ekco No. 434H horn router can be equipped with either 3, 5 or 7½ hp, 3600 rpm drive motor. Spindle speeds of either 10,000 or 20,000 rpm are obtained by means of a two-step drive pulley arrangement. An adjustable three-position positive depth stop has



been built in for precision step-routing, while the minimum clearance between the collet chuck and the horn measures 10 in. One standard pilot bracket and guide is furnished with the machine; however, others can be designed and supplied to special order. An air-operated coolant spray attachment is listed as optional and can be furnished at additional cost. For full particulars write to Ekstrom, Carlson & Co., Dept. M-17, 1400 Railroad Ave., Rockford, Ill.

T-10-1151

Air Hardening Flat Stock

The L. S. Starrett Co., Athol, Mass., has added to its lines a type of precision ground die and flat stock made to a special analysis for hardening in air. Five-percent chromium content makes this new die and flat stock especially wear resistant. It is recommended for punches and dies used in long production runs or for stamping silicon, stainless steel, monel and other abrasive materials. An average of 50 percent more pieces per sharpening can be expected than with oil hardening steel.

Because of its non-deforming characteristics, this air hardening die stock maintains accuracy of dimension throughout the heat-treatment process. Rejects due to cracking or distortion are eliminated and grinding to final size is substantially reduced. Its air hardening properties and wide hardening range make this flat stock easy to harden with consistently uniform results.

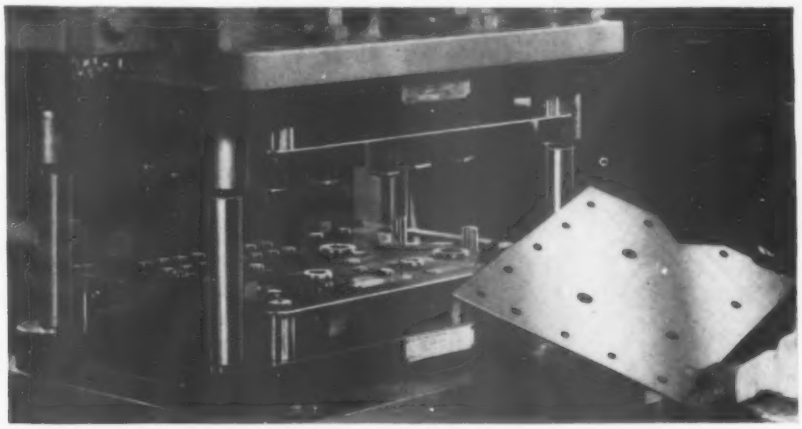
T-10-1152

New • Fast • Proven

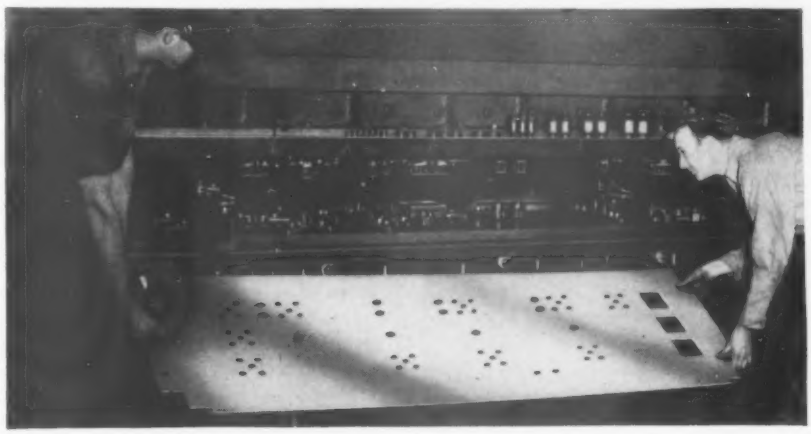
LOW COST methods for PERFORATING and NOTCHING SHEET METALS

REDUCE DIE COSTS

All units and parts are interchangeable and used repeatedly in different arrangements. **INCREASE PRESS PRODUCTION**—*Down time is minutes as compared to hours for change-over.* For precision work in all types and sizes of presses. **START PRODUCTION AT ONCE.** Pierce materials up to ¼" thick mild steel. Standard sizes and shapes available up to 3 inches. Special sizes to order.



Whistler *MAGNETIC* Dies at work in large inclinable press. Magnetized retainers hold the units. No bolting required. A fast, economical method in making up a punch and die set for short or long runs. All parts re-usable.



Whistler *ADJUSTABLE* Dies on perforating and notching job, using Tee slotted die set. With Whistler Adjustable Punch and Die units production starts within hours instead of weeks. Last minute job changes made quickly.

● Here are the complete details with prices and application illustrations. Send for these catalogs. No obligation.

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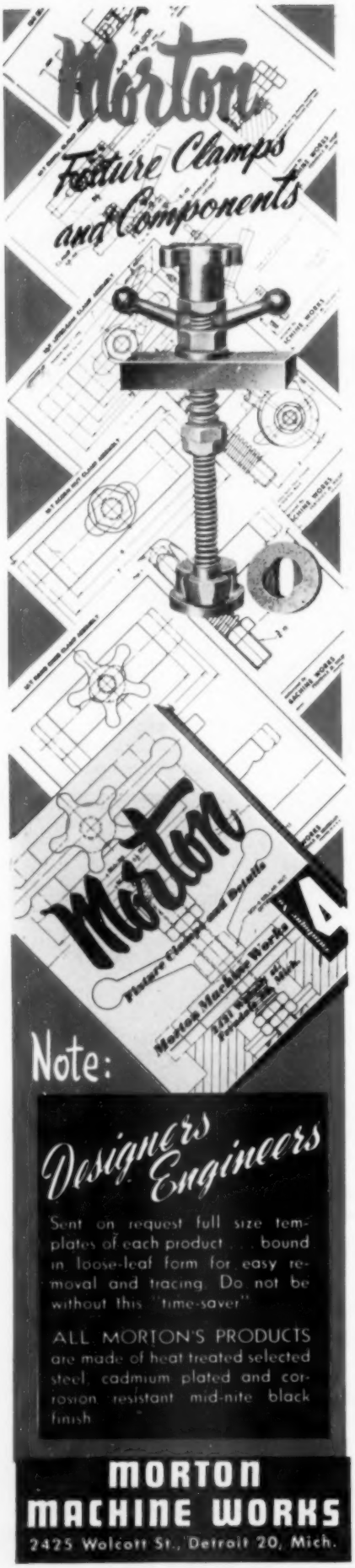
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INDICATE A-10-116-1

Cork-Surface Belt

A coated abrasive polishing belt that uses granulated cork rather than conventional mineral grains for obtaining a very high lustre on glass, ceramics, metal and plastic has been announced by Minnesota Mining and Mfg. Co., 900 Fauquier St., St. Paul, Minn.

Designated the 3M Wetordry brand polishing belt, it is designed primarily as a glass edge-polishing tool, although it is expected to find numerous applications in various other fields.

The belt is designed to replace the conventional buffing wheels and cork set-up wheels, eliminating set-up time and resulting in faster polishing, higher finishes, and lower unit cost. The cork surface of the belt is sized with resin combined with a polishing agent that is said to improve the polishing action.

The belt is made with a water-proof, cloth backing to which the cork granules are resin-bonded. Water is recommended as a lubricant in glass grinding operations and oil or grease for use with metal. The belt is used with the regular abrasive grit sequences in the grinding and polishing processes and results in a greatly improved surface finish, the company said. **T-10-1161**

Electrocleaner

Oakite composition No. 95, an electrocleaning material, is designed primarily as an electrolytic conditioner for zinc base die castings in preparation for plating.

In cleaning-conditioning of zinc base die castings, the manufacturers report that the Oakite composition No. 95 anodic conditioning process removes the surface films, disturbed metal and last traces of soil that are among the major causes of peeling and blistering. It also avoids the hydrogen gas formations that raise blisters when castings are heated after electroplating. Tests have shown that no blisters appear in plating on sound surfaces during the severe test of one hour of baking at 300 deg F. Even in highly porous areas, heat blistering is effectively minimized. Anodic conditioning with the compound removes all films that might impair the brightness of subsequent electroplates. The controlled, uniform action eliminates under-surface shadows caused by the deep etching of harsh cleaners. There is no blackening during anodic cleaning. Castings do not lose their brightness during the evenly-controlled conditioning process, it is claimed.

Additional information regarding this material and data on suggested operating procedures is available from Oakite Products, Inc., 158 Rector St., New York 6. **T-10-1162**

New!

KOEBELITE
TRADE · MARK

Cemented Diamond Particles

More efficient than conventional single diamond tools —with MUCH LONGER LIFE.

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Reduces set-up time—increases production.

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Now ready and proven: Koebelite CDP (Cemented Diamond Particles) Tool for Ex-Cell-O and J & L Thread Grinders, pictured above.

•

KOEBEL DIAMOND TOOL COMPANY
9456 GRINNELL AVENUE
DETROIT 13, MICH.

FIRST to give diamond users the advantage of diamonds set in powdered metal.

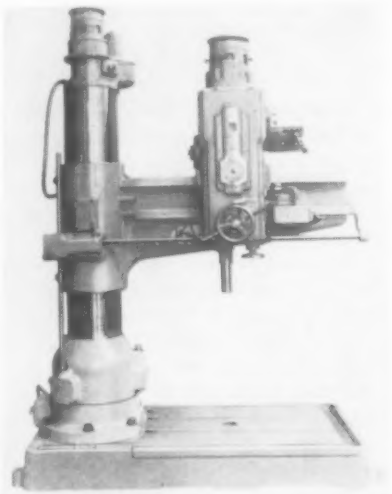
INDICATE A-10-116-2

Radial Drill

This radial drilling machine is furnished with a large massive ground column made of aged close-grain cast iron giving the maximum amount of rigidity with minimum deflection during heavy drilling.

The arm is of special design to insure the least torsional strain, deflection and natural sag from the weight of the head. The elevating and lowering has a special safety nut that prevents the arm from falling should the elevating nut fail due to wear.

These machines are furnished with the conventional standard base. Two-way, right-angle and three-way bases can be furnished in lieu of the standard base.



The spindle is of large diameter at the driving section, and is balanced by a compensating spring device, which runs in a hard steel sleeve and gives minimum support even when drilling in lowest position. The feed rack is cut integral with the sleeve. A No. 5 Morse taper is furnished.

The head is located in a Vee at bottom of arm, and has a bearing across the entire top of arm. The bearings are adjustable antifriction. Four different ranges of spindle speeds can be provided. Feeds are four in number, 0.007 to 0.029 in.

For further information write to British Industries Corp., International Machinery Div., 164 Duane St., New York 13, Division E-24. **T-10-1171**

Testing Machine

In many test programs, it is desirable to apply a load to specimens with extremely slow speed. This load must be capable of being stopped instantly. This tester serves these functions. Further, it does not require a variable speed drive or other electrical controls.

This instrument is available with the following grip clearances: 14¾, 24, 36 and 48 in. The basic dial is calibrated

with four individual scales broken down as follows: 10 lb. range with ½ lb. divisions; 25 lb. range with 1 lb. divisions; 50 lb. range with 2 lb. divisions; 100 pound range with 5 lb. divisions. A supplementary dial is available calibrated for 0-300 lbs. with 1 lb. divisions.

Accuracy of the hand operated tester is guaranteed to within ½ of one percent to meet ASTM requirements. A pendulum type mechanism set in carefully machined bearings is employed. A set of gripping fixtures for flat specimens up to ⅛ in. thick by 1¼ in. wide is included with each unit. These can be quickly removed and replaced with a variety of other standard grips.

Elongation readings with this instrument are provided by means of a special elongation scale and traveling hair line affixed to the moving platen.

Made by W. C. Dillon & Co., Inc., 1421 South Circle Ave., Forest Park, Ill. **T-10-1172**

1ST IN HIGH SPEED STEEL HEAT TREATING

Sentry

Sentry Models 2B-YP and 5Y are installed at Whitin Machine Works, Whitinsville, Mass.

Whitin Depends on Sentry for Uniform Tool Hardness!

"Our high-speed steel cutting tools get the uniform, swift, economical Sentry treatment, and we get tools hardened to perfection without distortion or troublesome "skin". A sample production day for one Sentry furnace is 92 large pieces."

See the Sentry Exhibit in Booths 1930 to 1952, Industrial Exposition, Chicago, Ill.

SENTRY MODEL YP
Vertical model for long, slender drills, reamers, broaches, etc.

SENTRY MODEL 2Y
For small tools, cutters of moly, tungsten and cobalt high speed steels.

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THE SENTRY COMPANY
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INDUSTRIAL ELECTRIC FURNACES AND EQUIPMENT FOR HEAT TREATMENT OF METALS

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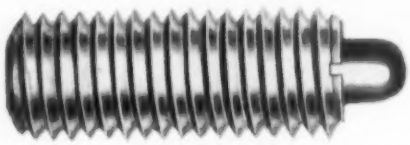
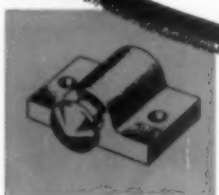
VLIER Spring Plungers & Stops

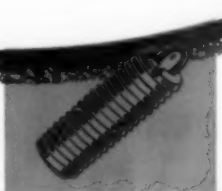
Save You Money in Hundreds of Ways



Here are the perfect units for replacing "makeshift" plungers in production and for end product use. Widely used for positioning small parts in fixtures, breaking oil seal in dies, as a locating pin, detents, etc. These units have long life and give trouble-free performance. Economically priced. There is a nearby Vlier distributor to serve you. Write for catalog No. 53 today.

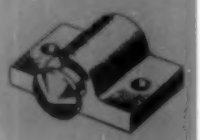


Completely assembled units, available in 13 sizes.

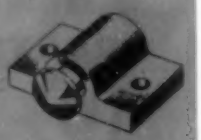


Pre-set, constant (3-42 lbs.) spring pressures.

Hardened plungers and rust-proof finishes give long life.

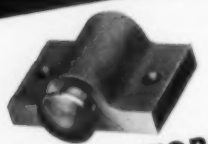


True plunger alignment in all positions.



Accurately-radiused plunger fully telescopes into body.

National Coarse Thread No. 1 fit prevents "freezing."



SPRING STOPS

For use where fixture design prevents the mounting of spring plungers. Body is jig-drilled for bolting to fixture-base. Has case-hardened, radiused nose. Available in two sizes with 14 or 32 lbs. spring pressure.

VLIER

VLIER MANUFACTURING COMPANY

4552 Beverly Blvd., Los Angeles 4, Calif.

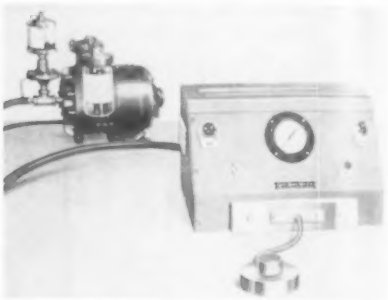
Manufacturers of

Torque Thumb Screws; Fixture Keys; Toggle Pads.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-118

Vacuum Tester

A vacuum tester introduced by Gits Bros. Mfg. Co., 1866 S. Kilbourn Ave., Chicago, can test many items which include shaft seals, diaphragms, cylinders, bellows, castings, small fuel tanks, pneumatic valves of all types, manifolds, miscellaneous aircraft parts, magneto parts, plastics, rubber and graphite.



Tests can be run to reveal porosity or surface fissures or to prove lapped surfaces, ground surfaces or surface flatness. The unit can also test effective sealing of complete assemblies and the efficiency of air cylinders.

The vacuum tester is small and compact and the complete unit comprises a vacuum pump and an instrument panel with an attached testing plate.

Plate size and composition are standard, but both may be varied to meet specific testing requirements. Optional equipment also includes a remote control starter to speed production line operation. The tester may be purchased with or without the vacuum pump. A single vacuum pump will operate several test panels.

Both the vacuum adjustment and the time cycle adjustment are independent of each other and may be adjusted separately. **T-10-1181**

Wet Blast Machine

An abrasive wet-blast machine for producing refined finishes on production tools is being manufactured by Abrasive Wet-Blast, Inc., Niles, Ohio.

Special abrasives suspended in water, applied by air pressure, is the operational procedure.

Metal removal is negligible, retaining all close tolerances on accurately machined tooling, since action of the process is to procure a refined finish on particular tools selected.

Form cutters, gear cutters, hobs, drawn dies—permanent die cast molds, extrusion dies, taps, etc., after having this finish applied increases their capillary attraction for lubricants. It also reduces friction, increases tool life between grinds and gives greater production, as the tendency is to eliminate pile-up on cutting edge.

T-10-1182

Diamond Grit Tool

Introduction of a diamond tool which already has demonstrated good performance is announced by the Wheel Trueing Tool Co., Detroit.

The new tool, which is known as the diamond grit tool, is another Wheel Trueing original and has been created especially for use in dressing thread grinding wheels for grinding threads ranging in pitch from coarse to fine, and in replacement of the more conventional diamond pointed thread dressing tools. It is available in models for thread grinding machines that grind V or straight line threads, either for production or gage work.

The factor that distinguishes the diamond grit tool from conventional tools is that the cutting element of the tool is a concentrate of selected diamond grits and Wheel Trueing's own alloy matrix, and presents a cutting face in any position. It needs only occasional turning to assure effective dressing work.

Dressing is accomplished in the same time as with the conventional single point diamond tool, but due to the type of dress accomplished with the diamond grit tool, the wheel does not break down as quickly and more pieces are produced between dressings. Further savings in tool costs result from the fact that only pure diamond grits are used and these grits are selected for the type of work they are intended to do, different work requiring different grit factors. The grits are combined with the matrix by means of a special process.

T-10-1191

Lightweight Aggregate

A new construction material with many potential applications in the building trades is described by a ceramics expert at Armour Research Foundation of Illinois Institute of Technology.

The material consists of tiny glass balloons, about the size of grains of sand, according to the announcement. Achievement of successful methods for manufacturing the material represents four years of laboratory effort.

Trade-named Kanamite by Kanium Corp., Chicago, which sponsored the development work at the Foundation, the material is a fine-grain lightweight aggregate made by blowing up individual grains of clay in a special furnace.

Concrete mixes using the new material in place of sand or other aggregates are very fluid, even though water content is low, it was said. This fluidity means that, for the first time in building history, contractors can fill forms with concrete pumped through rubber hoses. Construction costs can be lowered because of the virtual replacement of shovels and awkward metal hose.

Concrete, mortar, and plaster made with the material have proved to be strong and light. They also have good insulating qualities, it is claimed.

The inherent strength of the material has been demonstrated by making plaster specimens with it that show a compressive strength greater than that of specimens made with sand. The high strength of plaster made with the new aggregate will allow thinner coatings of plaster to be used on walls than are now possible. Being strong as well as light, the relatively thin layer of the plaster is able to support its own weight.

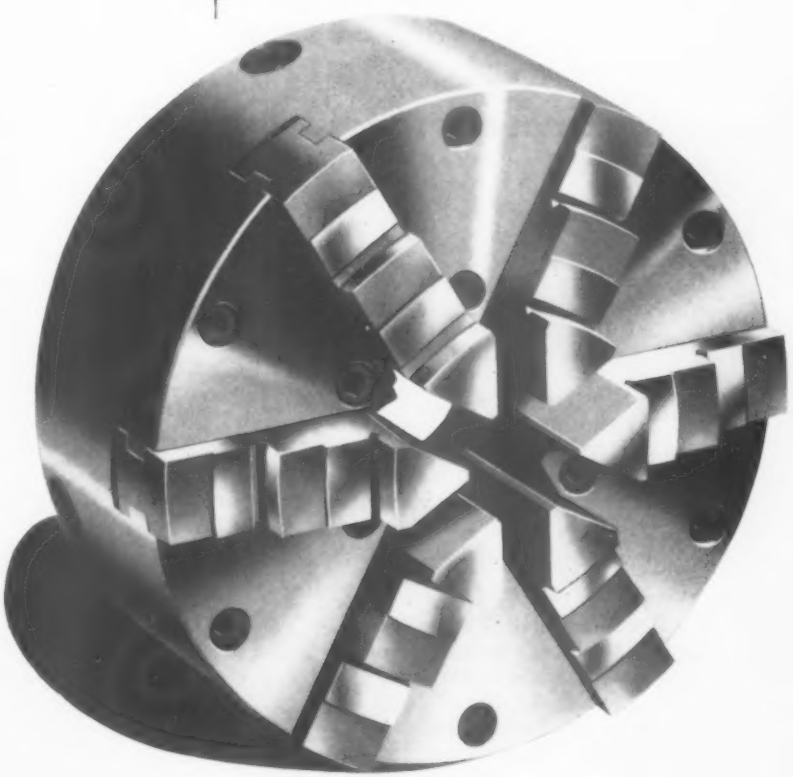
Individual particles of the new material are almost spherical. Their size varies with the raw material used and the method of processing. Sizes from 0.0116 inch to 0.0069 inch in diameter seem to be the most useful.

The material is made in mid-air, in the fiery atmosphere of a special furnace. Ground and screened clay is fed into the top of a vertical furnace. The individual grains of the raw material melt in the approximately 2700-deg F heat of a gas-air flame as they fall through it.

Gases given off by the tiny melted blobs at the correct instant inflate them into hollow spheres. The little glass balloons drop out of the flame and cool during the remainder of their fall. They are collected at the bottom of the tall furnace.

The material has potential applications in addition to the concrete, mortar, and plaster mixes already mentioned, it is said. As an ingredient of baked clay products it should make possible lightweight refractories and high-temperature insulating materials. It has almost unlimited possibilities, it is believed, as a filler in plastics and road-building materials. **T-10-1192**

Buck AJUST-TRU CHUCKS



.0005" precision *within 1 minute* . . . scroll chuck re-chucking speed . . . the surer, firmer grip of 6 jaws . . . collet precision production without the cost of collets . . . an end to most needs for stub arbors and mandrels . . . write for all the facts about these amazing chucks.

SIZES AVAILABLE:

3- and 6-Jaw Chuck—4" (light duty): 5", 6", 7½" (heavy duty)

2-Jaw Aviation Chuck—6", 7½" (heavy duty)

BUCK TOOL CO.

1033 Schippers Lane • Kalamazoo, Mich.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-119

STANDARD TOOL ON SPECIAL JOB *Reduces* TOOL COSTS 65%

Here's what happened during an inside threading operation at an atomic special project. A special carbide cutting tool was being used for the job, which requires a No. 10 Acme thread in steel S. A. E. 1030. Everything went wrong, however. Tools were breaking, and the result was not one piece was completed.

Mr. Howard G. Frisby, Jr., representative of Choctaw, Inc., Memphis, came to the rescue. He furnished a Wendt-Sonis standard AR style carbide tool bit, turned it up sideways and reground it on the job. Breakage was eliminated, the job finished and tool costs reduced 65%.

YOUR CHOICE OF CARBIDE

When you choose Wendt-Sonis, you select the brand and type of carbide you want. You also select from a complete range of Wendt-Sonis standard tool sizes. All Wendt-Sonis carbide-tipped tools have rust-resistant tool shanks made from highest quality steels for greater economy and faster production.

***Free!* CHIP BREAKER CHART**

Contains illustrations of chip-breakers, grinding instructions and recommendations for their use. Chart size with tab for wall hanging. Write: WENDT-SONIS COMPANY, Hannibal Mo.

WENDT SONIS

HANNIBAL, MISSOURI

580 N. Prairie Ave., Hawthorne, Calif.

549 West Randolph St., Chicago, Ill.

CARBIDE-TIPPED CUTTING TOOLS

BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS • DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS • ROLLER TURNING TOOLS • SPECIAL TOOLS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-120

Scheduling Calendar

The 1953 Schedule-A-Date desk calendar tells at a glance future dates by days, weeks and months for a year in advance.

The left-hand page of this standard-size desk calendar, for each day, has a concise, simplified listing of future dates by days, weeks, and months for the next twelve months. The right-hand page of the Schedule-A-Date calendar is a regular memo page with the date, a calendar of the month, and space for notes. The complete desk calendar includes a cold-rolled steel base with nickel arches and rubber feet. Pad pages are a standard $3\frac{3}{4}$ x 6 in., with holes spaced at two in. for a side-opening stand. **T-10-1201**

Thread Roller

Special thread rolling attachments have been designed and built which operate on the cross turning slide of the Bullard Mult-Au-Matic, rolling large diameter threads in the machine's normal cycle time.

Because threading and other machining operations are performed without rechucking, there is no loss of thread alignment, and the need for moving the part from one machine to another is eliminated. As a result, threads are held concentric with faces and shoulders, solving a major production problem.

One of the special threads being produced in machines equipped with these attachments is a $4\frac{3}{4}$ in.—12 thread on close tolerance rocket parts. Previous production of the part required a costly separate threading operation, as well as 100 percent inspection to assure exact alignment. The huge thread is now quickly and accurately rolled without affecting the Bullard's normal production.

Savings in threading labor, inspection, and greatly increased production have trimmed the cost of this large diameter thread to a fraction of a cent. At the same time, the attachments have insured greater squareness and a much higher degree of surface finish on the threaded length.

For information write to the Salvo Tool and Engineering Co., 26441 Gratiot Ave., Roseville, Mich. **T-10-1202**

Pocket Microscope

Optometer is the tradename of a 50-power pocket measuring microscope recently introduced by the National Instrument Co., 5005 Queensbury Ave., Baltimore 15. An engraved scale mounted in the body tube reads directly to 0.002 inch. Estimations can easily be made to 0.0005 inch. Precision, achromatic lenses, fully corrected for color and spherical aberration, result in a sharp image up to the very edge of the field of vision. This tool is about the size of a fountain pen and is easily carried in the pocket.

In the metal working industries, the Optometer is useful for measuring crest and root widths of threads, pitch and depth of threads; for measuring the radii of points and corners, width of slots, chamfers and grooves. Toolmakers use it for measuring the dimension from a center punch mark to a scribed line. The Optometer is ideal for measuring the diameters of small holes in gauges and heading dies, diameters of impressions in Brinell tests and for other surface measurements. Mechanical parts can be inspected for wear, welds can be quickly examined without the necessity for sample analysis.

In use, the Optometer is placed on the surface of the part to be inspected and a light directed obliquely toward the tapered opening. The focusing knob is moved back and forth until the object is in focus. The linear dimension is read directly on the graduated scale. **T-10-1211**

Milling Cutters

Staggered tooth, indexable solid carbide blade, side milling cutters have been added to the line of Futurmill cutters by the Detroit Milling Cutter Co., 28625 Grand River Ave., Farmington, Michigan.

Illustrated is a 9-in. 18-blade staggered tooth side milling cutter designed to mill a 1½-in. wide slot in an armor casting. The solid carbide blade has a ⅛-in radius ground on each corner and when dull can be simply indexed to another cutting position. Eight indexes in all are possible, with size being maintained within 0.001 in.

With this design of cutter the minimum width is approximately 1¼ in. where the teeth are staggered, but straddle mills designed to cut on one side only can be made to a minimum thickness of 1 in. or more, depending on the size blade to be used. **T-10-1212**

Pete says the only thing that will shear his wife's biscuits is Columbia Buster Alloy Tool Steel.

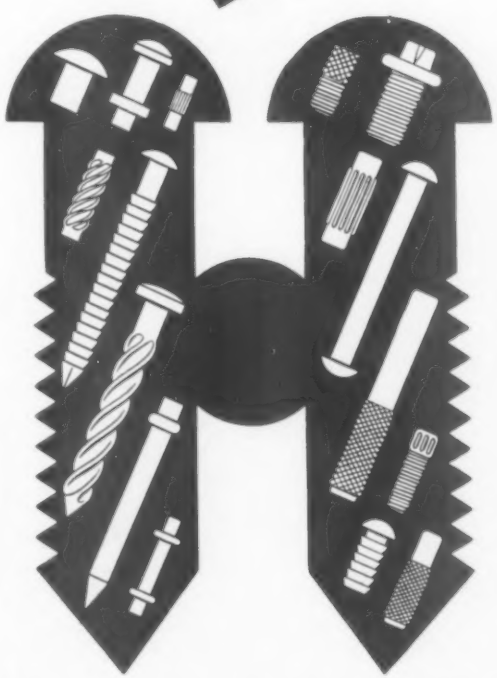
COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILL.

Producers of fine tool steels—High Speed Steels Die Steels—Hot Work and Shock Resisting Steels Carbon Tool Steels.

TOOL COLUMBIA STEELS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-121-1

HASSALL SERVICE



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. . . nails • rivets • screws

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. . . and to your specifications in any metal. Large raw material inventory for your convenience. Send drawing — advise quantity.

Free catalog on request.

SPECIAL NAILS RIVETS SCREWS — Hassall — ESTABLISHED 1850

JOHN HASSALL INC.

130 Clay Street
Brooklyn 22, New York

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-121-2

Contouring Attachment

An improved simplified hydraulic contouring attachment with greater sensitivity and accuracy has been developed for Springfield lathes when turning, boring and facing on shafts, axles, rotors and other parts with varying diameters, shoulders, tapers, radii and flanges.

Pilot or control circuits, remote control valves and other troublesome elements have been eliminated and there are no complicated mechanisms or fragile units to cause trouble. Instead, a motor-driven hydraulic pump, relief valve and oil reservoir are a single, self-contained power unit which supplies hydraulic pressure to the servo-valve and fully universal hydraulic compound rest.

In operation, with the carriage or cross slide feed engaged, the stylus scans the full-size templet. The stylus motion is transferred through the lever arm directly to the servo-valve which meters oil flow to control the hydraulic cylinder. As the piston is stationary on the tool slide, a cylinder movement results in a tool movement and the servo-valve is so sensitive that even the slightest pressure is sufficient to move the tool.

In addition, Springfield has a simple electro-mechanical constant cutting speed control. It governs a variable drive and maintains constant cutting speed as the lathe follows a varying contour to give the utmost cutting tool efficiency and uniform finishes.

Other improved features of this contouring attachment are a positive, smooth, continuous back-lash-free hydraulic movement which gives a superior finish, and elimination of long hydraulic lines which produce sluggish action and inaccuracies. Opposed hydraulic pressures in the hydraulic cylinder hold the slide securely for heavy duty cutting. The turret tool post permits a wide variety of tooling arrangements including long tools for contour boring and the full universal hydraulic compound swivels to the best angle for contouring each individual job.

Standard Springfield lathes are used with the Springfield hydraulic contouring attachment, and quick changeover from standard operation to contouring is easily made by substituting the hydraulic compound for the standard rest.

Made by the Springfield Machine Tool Co., Springfield, Ohio. **T-10-1221**

Waterproof Sandpaper

Behr-Manning Corp., Division of Norton Co., Troy, N. Y., announces the development of a waterproof sandpaper for industrial users, Tufbak Speed-wet Durite paper.

Highlighting the features of Tufbak are freeness of cut and ability to maintain the initial sharp bite necessary in wet sanding. A new tough backing permits maximum flexibility. Its increased body strength resists creasing, cracking and curling.

This combination of toughness and flexibility increases durability, mileage, hand, and resistance to skidding and peeling of grit. These advantages are obtained whether the sheet is soaked in the usual liquids for a few minutes or for hours. **T-10-1222**

Air Dry Lubricant

An air dry lubricant, which may be sprayed or brushed on, is announced by Electrofilm Corp., 7116 Laurel Canyon Blvd., North Hollywood, Calif.

Lubond has excellent lubrication characteristics at temperatures from —70 to 300 deg F. It may be applied to steel, iron, stainless steel, lead foil, aluminum, brass, wood, cork, etc., and is resistant to hydraulic fluids, gasoline, lubricating oils, and water.

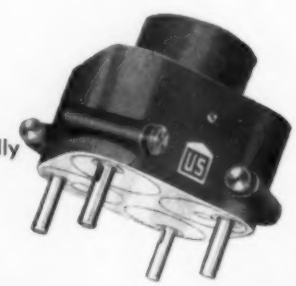
Before applying the lubricant, the surface should be free of grease. Improved results can be obtained by conditioning the surface **T-10-1223**

COMPARE THE PRICE....
AND PERFORMANCE.....
and you'll rely on us for any type of multiple spindle fixed center, adjustable or individual lead screw tapping head.

Universal joint with slip spindle fixed locating plate.

Two spindle head unit—one spindle fixed, the other spindle adjustable for the fixed positions.

Single eccentric type for equally spaced holes on bolt circles.



US HEADS

UNITED STATES DRILL HEAD CO.
CINCINNATI 4, OHIO

SINCE 1915

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-122

Power Take-off

Featuring a high degree of flexibility for electric power distribution, the heavy duty Feedrail trolley busway system provide a movable source of power for long runs of heavy moving electrical loads. Power take-off trolleys ride in a steel housing that safely encloses the current carrying bus bars. It facilitates lateral and transverse movement of heavy tonnage cranes and hoists. Portable welding equipment or other electrical apparatus can be quickly relocated and placed in operation immediately. Standard factory-fabricated enclosed bus bar sections and accessories combine to make a run of any length. Allowance for unequal expansion between the copper bus bars and the steel track housing has been provided. Door track is available for inserting trolleys quickly and safely without shutting off the power. This standardization allows for matching future plant growth or rearrangement of the electric distribution system. Every provision for safety has been incorporated in the design. All current carrying parts are enclosed to eliminate hazard to workers and equipment. Aisles and work areas are kept clear as only short overhead cable connections are necessary.

Silver alloy brush type contacts of large sectional area assure positive pressure and alignment with the current carrying bus bars. At either end of the trolley vertical undercarriage wheels prevent upthrust and horizontal wheels prevent side slewing. Terminal box is equipped with positive pressure type solderless lugs and cable grip. Pantograph type linkage permits simple strain-free attachment of trolley to movable electric equipment to be powered. The systems are rated 250, 375 or 500 amperes, 250 volts dc, 275 volts ac, single- or three-phase.

Made by the Feedrail Corp., 125 Barclay St., New York 7. **T-10-1231**

Silver Brazing Material

Silver brazing materials which eliminate the major drawbacks of conventional silver brazing practices are now in production at the plant of the American Silver Co., 36-07 Prince Street, Flushing 54, N. Y.

Called Braze-Clad metals, they permit the achievement of flawless blind joints and joints of long cross-section without reliance on the skill of the operator.

Braze-Clad metals eliminate voids and oxide islands, and produce joints that are effective over 100 percent of the bonding area. They cut fluxing and cleaning time, and simplify assembly set-ups by making conventional preplacements unnecessary.

These metals are combinations of various base metals (ferrous and nonferrous) clad with a predetermined thickness of silver brazing alloy on one or both sides. The brazing alloy (which is available in a wide selection of melting points) is pre-diffused into the surface of the base metal by the application of heat and pressure.

Chief among the drawbacks of silver brazing when alloys in standard form are employed are: balling-up in the first stages of heating; and uneven, unpredictable spread after that. This is eliminated with Braze-Clad metals, because the base metal anchors the silver brazing alloy in place throughout the heating cycle. The alloy flows, but never runs: it stays put, and retains its uniform thickness.

Because the brazing alloy on "Braze-Clad" metals is anchored to the base metal, the flow of molten alloy is closely controlled—doing away with extensive after-brazing operations to remove unwanted overflow, burrs, or fillets. In addition, joint preparation operations, such as fluxing and cleaning, are cut in half, since conventional preplacements (rings, washers, special shapes) are no longer needed. **T-10-1232**

Grease Fitting

The problem of protruding heads of ordinary grease fittings being knocked off by a heavy blow or collision is remedied by a new line of flush-type grease fittings introduced by Universal Lubricating Systems, Inc., 622 Allegheny Ave., Oakmont, Pa.

New design incorporated in the flush-type fittings makes them advantageous on machinery where protruding fittings are undesirable.

In place on a machine, the head of the Universal flush-type fitting represents negligible obstruction or opportunity for collision that might knock it off and impair the machine's function.

The fittings are made with a ball check. Supported by a spring, the ball prevents oil or grease leakage caused by back pressure. The ball, which holds the opening normally closed and cannot be unseated, is depressed for oiling or greasing.

The back-up spring is designed so passage through it at the point of fullest depression is greater than the opening at the top of the fitting. This provides free flow of lubricant.

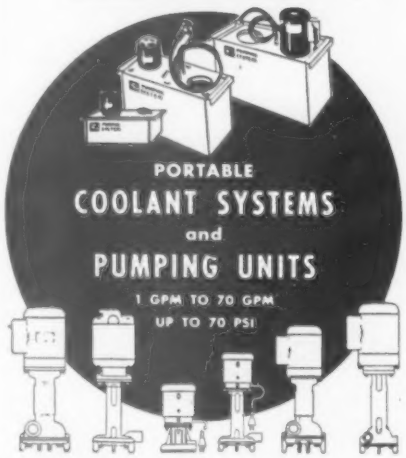
A complete line of the flush-type fittings is offered in all regular sizes.

T-10-1233

USE READER SERVICE CARD ON PAGE 101 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

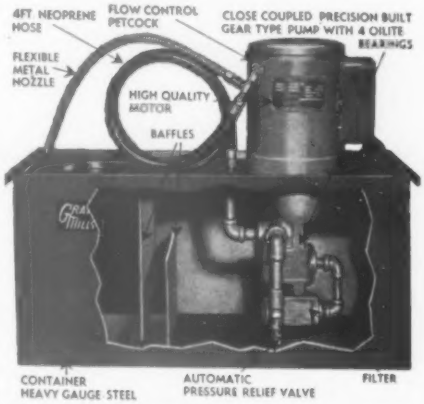
Get More Production from your Machines with

GRAY-MILLS



PROPER application of coolants mean increased production and time and tool savings. You can have these advantages for every machine—small, large, and special—with Graymills Portable Coolant Systems.

They can be installed in a few minutes, are modern in design, and of heavy duty construction with built-in automatic pressure relief valve on gear pumps.



Sturdy high pressure gear models . . . smooth high volume centrifugal types in 1/25 to ½ HP ratings, 1 gal. to 70 g.p.m. with tank capacities from 5 to 38 gals. Also immersion type centrifugal pump and motor units.

MOST INDUSTRIAL DISTRIBUTORS STOCK STANDARD UNITS.

WRITE FOR NEW CATALOG SHOWING SELECTION CHART . . . TELLS THE RIGHT PUMP OR COOLANT SYSTEM FOR THE JOB.

GRAYMILLS CORPORATION
3729 LINCOLN AVENUE • CHICAGO 13

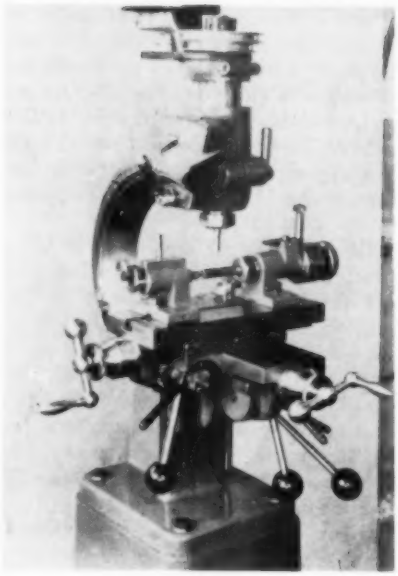
INDICATE A-10-123

Micro Miller

The Micro-Miller, distributed in the U. S. by E. R. Bachmann, 27-11 41st Ave., Long Island City 1, N. Y., features a half circle protractor dovetail which guides the spindle assembly into a vertical, horizontal, or any intermediate position. The milling head with motor and V-belt drive can be securely locked in any position of a 90-deg graduated arc.

The machine features a horizontal table of $3\frac{1}{2}$ x $\frac{5}{8}$ in. The longitudinal travel is 4 in., the cross travel $3\frac{3}{8}$ in. and the vertical movement $4\frac{3}{4}$ in. These three movements can be effected either with a hand-operated crank and feed screw or a quick-action plastic knob lever for production runs. The change-over from one type of operation to the other is by an instant-release lock.

Through the fact that the spindle assembly also features a vertical movement, the machine is universally adaptable as a vertical, horizontal, and universal milling machine, a universal drill press and boring machine, a grinder and a small lathe.



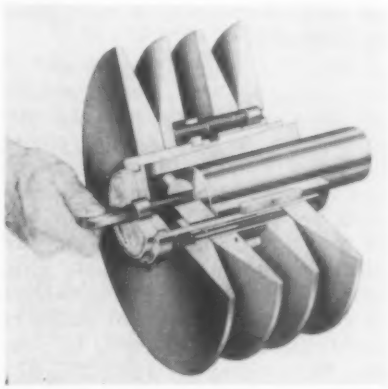
The machine is mounted on a pedestal, allowing easy all-around access.

Tools are normally held in the spindle by spring collets, the maximum bore of which is 13/32 in. A universal three-jaw chuck can be adapted to the spindle in place of the collets. As extra accessories a milling vise and dividing head are available. **T-10-1241**

Variable Speed Drive

A variable speed drive incorporating the Taper-Lock principle has been announced by Dodge Mfg. Corp. of Mishawaka, Ind.

Components of this variable speed drive are a variable pitch motor sheave, a set of wide range belts, a companion sheave and a slide motor base. The Dodge Taper-Lock principle is used in the bushings for both sheaves in the drive and contributes greatly to the rapidity and ease with which speed changes can be made. The drive is compact and the sheaves occupy a minimum space on the shaft.



The variable sheave assembly locks on the motor shaft as a unit with the turn of a screw.

The pitch diameter is changed by means of a one-point adjustment. The single adjusting screw may be located at either end of the sheave although normally the sheave is factory assembled with the adjusting point located on the motor side.

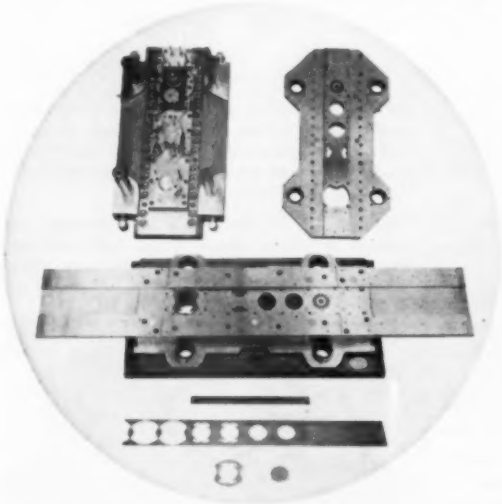
The precision grooved companion sheave in the drive is factory-balanced and, being held firmly to the shaft by the Taper-Lock bushing, runs true.

The slide motor base permits changes in center distances to preserve proper belt tension as the variable pitch sheave is adjusted for different speeds. The base is of all-steel construction. A full range of centers is provided with a turn of one screw. It is compact, of flush design, and is available in a full range of sizes for NEMA frame motors.

T-10-1242

This die was not just "made"...

it was ENGINEERED



Just a choice of words, you say? No, it's more than that. The progressive steel lamination die shown here was hole-bored, hole-ground and contour-ground to pre-engineered dimensions entirely on Moore-built machines in the Moore toolroom. It exemplifies the application of *engineering* principles that put die-making on an interchangeable parts-and-assembly basis for the first time.

Let's take a close look at this die: All die sections are mounted in a hardened nickel-chrome frame for maximum production and die life; the die set was specially made by Moore. The spring stripper is guided on four main posts. High-speed inserts are set into hardened steel frames.

Moore produced all parts of the die *to figures instead of to "fit."* This was done concurrently by several toolmakers instead of progressively as a slow, one-man job.

Precision Hole Location and Contour Grinding Methods Assure Accuracy, Speed, Economy

THE NO. 2 MOORE JIG BORER bored all holes before hardening, thus holding the location as close as possible to eliminate excessive grinding. With its built-in system of accurate lead screws, the Moore Jig Borer can spot, drill, bore or ream all holes in a workpiece with minimum tool changes and to close tolerances.

No. 2 MOORE JIG BORER

Punches and dies of the first station—at the right in the photograph—were ground with a *Moore Panto-Crush Wheel Dresser*. This machine, which combines roll-crushing and diamond dressing, did the required linear contour grinding quickly and efficiently. *Moore Motorized Centers* handled several of the smaller grinding jobs.

WITH THE NO. 2 MOORE JIG GRINDER, all die sections were screwed and doweled into place, put on the machine and ground in *one* set-up. This eliminated separate section hole-grinding and the accompanying difficulty of accurately locating each section in the die bed. The Jig Grinder does the job in one-third the time required by previous methods.

No. 2 MOORE JIG GRINDER

To grind Stations 2, 3, 4, 5 and 6, the new contour-grinding and slot-grinding features of the Jig Grinder were utilized.

Die try-out and assembly operations were performed the modern, fast, "mechanized" way on the *Moore Die Flipper*.

End results? Moore equipment brings true interchangeability to the toolroom, lowers tool costs, increases toolroom capacity, prolongs die life and achieves greater accuracy.

Detailed bulletins on these machines are yours for the asking—today. Write to: Moore Special Tool Company, Inc., 732 Union Avenue, Bridgeport 7, Conn.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTO-CRUSH WHEEL DRESSERS
DIE FLIPPERS • MOTORIZED CENTERS • HOLE LOCATION ACCESSORIES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-124

Four-Way Drill

Semi-automatic drilling, boring and facing machine has been developed by Modern Industrial Engineering Co., 14[illegible] Birwood Ave., Detroit 4, to meet the specialized production needs for aircraft jet engine compressor housings.

The machine has four motor-operated heads located at 45-degree positions around the index table. The first head core drills, spotfaces and countersinks a large hole in one of four identical mounting bosses located at 90-degree positions around the housing. The second head drills four holes in the pad face. The third head turn-faces the surface of the pad and the fourth finish bores the core-drilled hole. Nine 45-degree indexes of the table finish all four pads.

Five-horsepower motors power the first and second heads while three-horse-power motors drive the third and fourth heads.

Manual indexing has been provided to permit inspection of both the tools and the part between successive precision machining operations. This avoids possible scrapping of valuable precision parts due to worm or broken tools.

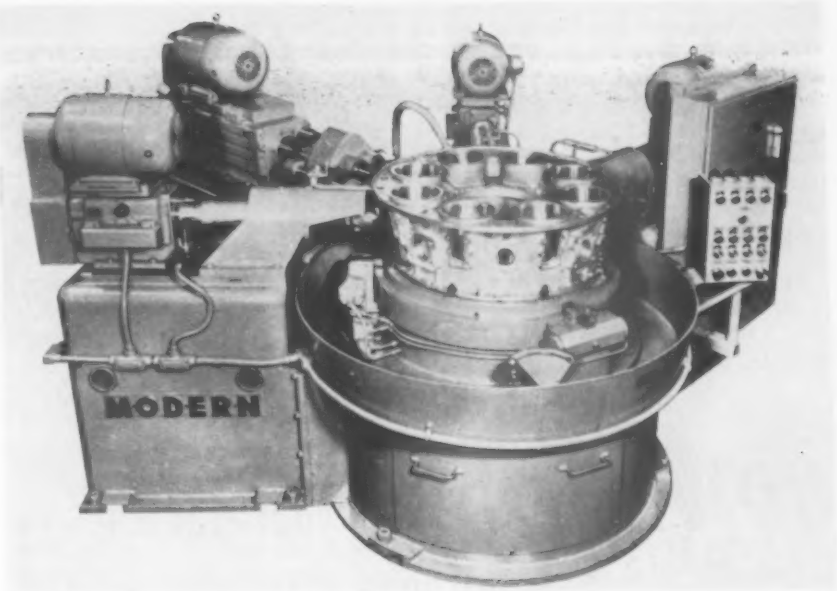
A compressor housing is located on the index table of the machine by an OD locating ring and a pin locator that fits in one of the flange holes in the housing. The part is held in position by hold-down bolts that are accessible by rotating the index table, which is supported by hardened steel balls.

In operation the index table must be in loading position with the index pin bottomed before the cycle of the machine can be started. Three air cylinders lock the index table down when the index pin is in position.

The index table can only be indexed in one direction and it is designed so that it will not overshoot successive index locations. The four heads are sequenced automatically in their cycle of operations so that the correct head or heads feed at the correct index location.

If for any reason, the operator wishes to move the work to a position not in the cycle of operation, a manual control is provided so that the table can be rotated and jogged through the index locations without feeding the heads.

T-10-125



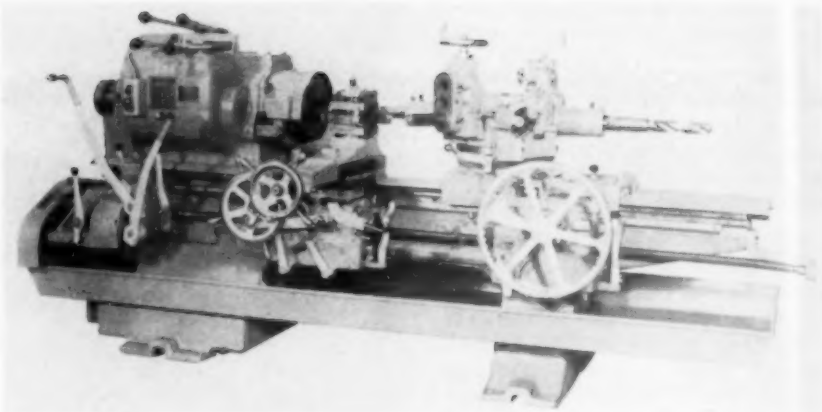
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-125

USE READER SERVICE CARD ON PAGE 101 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Turret Lathes

Recently made available for delivery in the United States is the CMC No. 34½ turret lathe manufactured by Canada Machinery Corp. Ltd., Galt, Ontario, represented in the U. S. by Pitnam Industrial Products Co., a division of Cement and General Development Corp., 608 Fifth Ave., New York 20.

The CMC No. 34½ turret lathe has a 4½ in. collet capacity and, according to the manufacturer, embodies standard American design and construction practice. The head stock provides 12 spindle speeds from the high-speed drive



shaft through alloy steel heat treated and precision shaved gears. There are 16 longitudinal feeds to each carriage, ranging from 0.005 in. to 0.166 in. per revolution of spindle and 16 cross feeds to the cross slide carriage, ranging from 0.0025 to 0.083 in. Eight feeds are conveniently changed by two levers on each apron while a third lever at the left hand of the machine doubles this range.

Spare parts and services are available for U. S. buyers. Other features include particularly rugged construction throughout, including bed made from well seasoned semi-steel casting, well ribbed with ample bridges; aprons made from double-walled single-piece castings; and a heavy hexagon turret indexed by a hardened tapered index pin and locked by a large diameter double tapered collar; bed ways completely covered by telescoping covers; power rapid traverse for the hexagon turret provided in either direction controlled by a lever at front of saddle; rigid cross slide carriage which can pass under the chuck, enabling the turret to be brought up close to the work and eliminating excessive tool overhang. **T-10-1261**

Sealing Tape

A felt sealing tape with a solvent-activated adhesive back (one side) has been developed. It is identified as King Felt No. 113.

The primary feature of this product is the strength of the adhesive which permits application to cold metal and many other surfaces. It differs from the conventional, pressure-sensitive adhesives in that it provides a permanent bond rather than serving as an application aid only.

Besides regular rolls, this product is also available in pre-segmented rolls for the production application of equal-size pieces. Each segment is pre-cut to a sufficient depth to allow easy detaching.

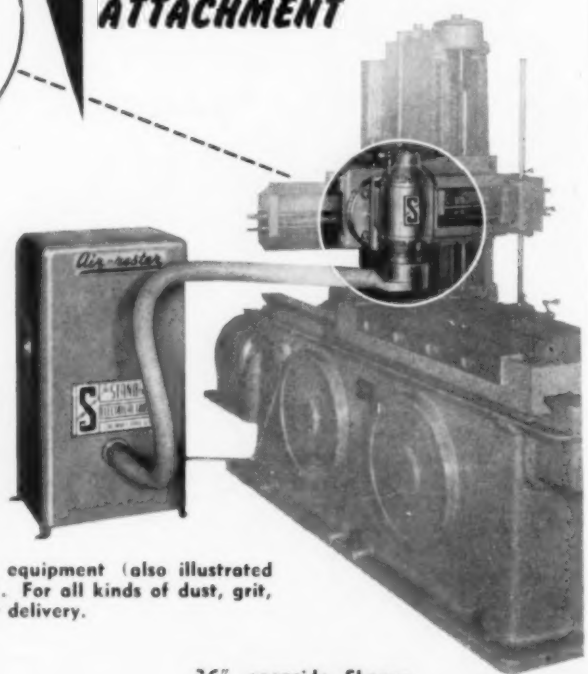
Available in widths from ¼ to 66 in. and thicknesses of 1/32, 1/16, ⅛ and ¼ in. Made by Products Research Company, 3126 Los Feliz Blvd., Los Angeles 39, California. **T-10-1262**

NOW... you can make your machines double purpose machines with

STANDARD'S
PRECISION GRINDING ATTACHMENT

PLANERS
BORING MILLS
SHAPERS

quickly converted!
Type PAV from ½ H.P. to 25 H.P. Speeds from 3600 to 1200 R.P.M. Equipped with vertical or horizontal feed, or both. Micrometer feeds. Hollow spindle for wet grinding. For cup wheel, plate mounted cylindrical wheels, or straight grinding wheel. "AIR-RESTER" dust collecting equipment (also illustrated and available separately). For all kinds of dust, grit, etc. Three Sizes. Prompt delivery.



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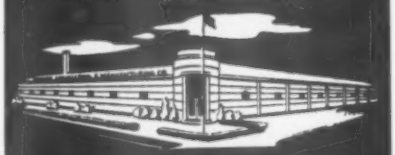

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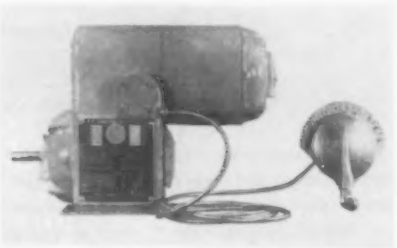
INQUIRIES PROMPTLY ANSWERED

INDICATE A-10-127-1

Variable Speed Motor

A lightweight motor type 5 VA, in fractional horsepower equipped with mechanical remote control is now available. The remote control feature includes a control handwheel with indicator dial and a five-foot flexible cable so that the machine operator can control the Varidrive's speed at a distance from



the motor. An advantage of this control arrangement is that the dial indicator is a part of the control, making it unnecessary to go to the motor to see what the speed is. Connecting cable longer than five feet can be used if necessary. Type 5 VA Varidrive has been made available in ¼, ⅓, ½ and ¾ hp and in a speed ratio up to 10 to 1 over a range of 4 to 10,000 rpm. The entire unit is a one-package motor with the variable speed mechanism enclosed. Further information may be obtained from U. S. Electrical Motors Inc., Box 2058, Los Angeles 54. **T-10-1271**

Welder and Charger

A combination a-c arc welder and battery charger, reconnectable for 110- or 220-volt operation has been announced. The welder, model 175-BC, was designed to meet the demands of repair shops, maintenance men and farmers for an all-purpose, all-around heavy-duty portable type welder.

The model 175-BC lists the following features: 15 to 175 amperage output range; 140 amperes rated output; arc voltage, 25 volts; open circuit voltage, 65 volts; power factor correction of 75 percent; duty cycle at rated amperage load, 50 percent; duty cycle above rated amperage load, 20 percent; 36-amp. draw at 220 volts; kva at rated output, 7.9.

The combination welder and charger handles rods from $\frac{1}{16}$ to $\frac{5}{16}$ in. and is also available without battery charging circuit. The model 175-BC welder is covered by a regular 5-year burn-out proof guarantee.

The welder meets NEMA standards and REA specifications. The amperage range is said to be wide enough to meet any farm, maintenance or repair shop requirement.

Further information may be obtained by writing Mid-States Welding Mfg. Co., 6025 S. Ashland Ave., Chicago 36. **T-10-1272**

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WRITE FOR CATALOG

INDICATE A-10-127-2

Industrial Trucks

These trucks have a turning radius well within the limitations of practical aisle widths, and are maneuverable in close quarters. The center-pivoted steering axles, with rubber-mounted bushings and angularly-placed tie-rods to absorb road shocks, are standard on both gas and electric types.

A new fork mounting is standard on both Utilitruc models. This mounting is a step toward interchangeability of attachments and devices between all makes of trucks with comparable capacity. They have a Free-lift of 25 inches and more lift is provided by a new upright design which does not increase upright height. Greater driver visibility is afforded by this design.

On the electric model increased braking efficiency is achieved by a deadman or parking brake which functions automatically when the driver leaves the seat. The parking brake on the gas

model is mechanically connected to the brake shoes and uses the Orscheln hand lever to insure positive braking action.

Maximum accessibility is provided to engine compartment or motors and controller in both the gas and electric models. Driver comfort has been improved by placing all controls within easy reach and, on the gas models, all instruments, including ignition switch and starter button, are conveniently placed in a dash panel on the steering column. Cushion-type tires are standard with either power type.

For further information write to Clark Equipment Co., Industrial Truck Div., Battle Creek, Mich. **T-10-1281**

Center Finder

Black Drill Co., Inc., 1400 E. 222nd Street, Cleveland, O., have developed and now are in production on a device designed to save time and cut cost of finding centers on runs of material regardless of shape.

The device consists of two opposed pneumatic cylinders mounted on a cast iron base with two master jaws at the ends of the rods attached to the pistons. The jaws travel along guides and the movement of both jaws is mechanically synchronized. It operates on 5 to 100

pounds air pressure depending upon the force wanted at the jaws. The delivered pressure on the work is the total pressure exerted by both cylinders. Clamping pressures up to 2000 pounds may be obtained.

The Center-Finder vise is so designed that the force exerted on the jaws is straight-line from the air cylinders. No pressure is transmitted through the synchronizing mechanism at any time. Its only function is to guarantee uniformity of jaw travel to both open and closed positions.

In operation, the jaw tolerance from the established center line is ±0.001 in. at any dimension of jaw closing, with a working range of 0 to 4 in. With this device, the center of the workpiece, regardless of diameter provided it is within the range mentioned, is brought within ±0.001 in. of the established centerlines both horizontally and vertically.

The vise requires less than two square feet of bench space. Four bolts hold it in position. One air line connection to a four-way valve places it in operation. Each jaw is independently adjustable from the center line to accommodate work pieces other than symmetrical. False jaws to accommodate any situation are readily fitted to the master jaws.

T-10-1282

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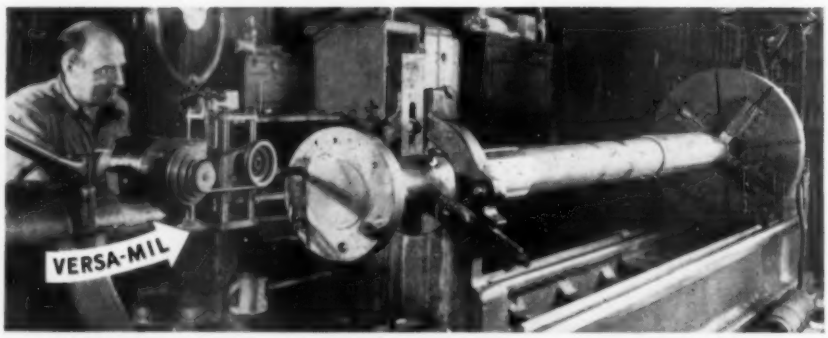

6 holes drilled, bored, and spot faced in forged steel flange of propeller tail shaft at Rodermond Industries, Jersey City. Finished holes 2.000″ + .001″ — .000″. Cut shows third operation: 1¾″ drill power fed 1″ per minute into 1⅛″ hole.

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Versa-Mil Basic Unit shown will mill, drill and bore at 13 speeds up to 450 rpm. Accessories enable you to mill and drill at speeds up to 5500 rpm, and grind at 3000 to 18,000 rpm, all to close machine-tool tolerances.

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USE READER SERVICE CARD ON PAGE 101 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Thermocouple

A thermocouple assembly has been designed to precisely detect temperatures in masses as small as plastic masses of two ounces. The unit can be used for measuring bearing temperatures and for many other processes.

The type J thermocouple assembly was developed by Minneapolis-Honeywell Regulator Co. to overcome production difficulties in the plastic industry where the mass to be controlled is too small to support earlier models of the thermocouple assemblies.

For maximum quality production in any plastic injection or extrusion molding process, the announcement said, it is necessary to maintain correct operating temperatures in the mold or the die, and the heater. Excessive temperature errors result in incompletely filled molds or dies and cause charring of the plastic. Even slight errors cause extreme flash, shrinkage, and distortion if the temperature is too high, and flow marks, dull surfaces, poor welds, and low impact strength result if the temperature is too low. In general, the more complex the mold or die design, especially if it is of large area or contains thin sections, the narrower are the temperature limits.

If the extrusion or injection temperature is reduced to provide a safety factor, production is slowed and the resulting temperature variations make it impossible to time the press cycle accurately. Both the die or mold and the heating cylinder (in extruders and injection molding machines) must be maintained at the proper temperature.

The new type J thermocouple can be placed in the die or the mold so that the measuring junction is as close as practical to the cavity. Other thermocouples can be inserted at several points on the outer wall of the heating cylinder. A compression sleeve facilitates rapid changing, resulting in a minimum of lost production time when a thermocouple replacement is necessary.

The new thermocouple consists of a 3/16-inch OD stainless steel protecting tube, available in lengths of 3, 4, 5, 6, and 8 inches, with a ⅛-inch pipe thread compression fitting for attaching the protecting tube to the mold. The thermocouple is constructed of 20-gauge Fiberglas insulated iron constantan. A flexible bronze armored tubing, in lengths of 4, 6 and 8 feet, with ½-inch pipe connection on its free end, is silver-soldered to the protecting tube. The construction permits the leads to be made up in a conduit on a stationary part of the machine, leaving the thermocouple free to move with the mold during its cycle. **T-10-1291**

Gear Motor

A gear motor, designed to simplify maintenance in case of electrical failure of the stator, has been announced by General Electric Company's small and medium motor department.

The motor is built in three pieces to permit quick and easy removal of defective stators without disturbing gear components or gear connections to the load. Its design includes a G-E motor; a compact, planetary gear; and a mechanical adapter.

The gear is available in speed ratings of 780 to 13.5 rpm.

The mechanical adapter serves the triple function of acting as the pulley end-shield for the motor, the motor end-shield of the gear housing, and a mechanical spacer for easy accessibility to the stator frame bolts.

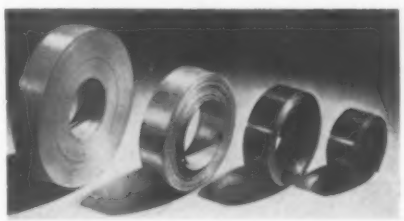
The stator can be changed with the removal of only bearing-enclosure screws, the bolts that hold the front end-shield to the stator, and bolts holding stator to the motor adapter. A defective stator can be replaced by either another roundframe stator or by an ordinary, standard-motor stator with feet. If a standard stator is used, it is necessary to mount it upside down so its feet do not interfere with the gear-motor feet.

The motor is available in ratings of 1 to 75 hp for standard applications and up to 200 hp for special applications.

T-10-1292

Pre-Cut Strapping

These small coils of metal strap are cut to exact customer's specifications. The coils may be used in connection with portable kits employed in applying insulating materials, street signs, television antennas, furnace boxes, etc. Coils of any width or thickness in stainless, monel, etc., can be furnished in



lengths up to 36 ft. The company will also coil customer's strap if sent to factory. For further details, write A. J. Gerrard & Co., 1950 Hawthorne Ave., Melrose Park, Ill. **T-10-1293**

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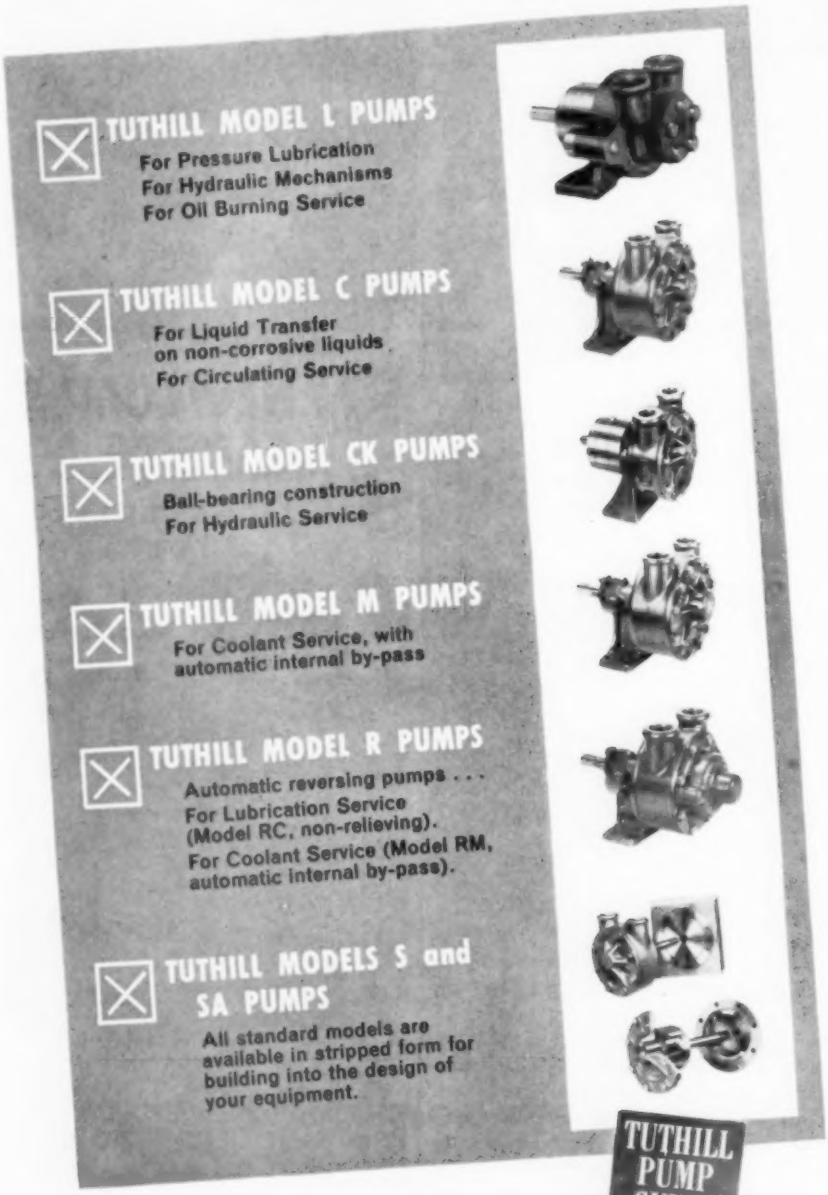
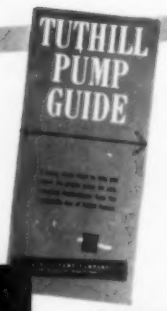


To make it easy for you to choose the right pump for the job, Tuthill offers the handy new Pump Guide . . . a letterhead-size table which gives you full details on the complete line of Tuthill Pumps.



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Good Reading

A GUIDE TO SIGNIFICANT BOOKS AND PAMPHLETS OF INTEREST TO TOOL ENGINEERS

PRACTICAL METALLURGY FOR ENGINEERS, *by the Research Staff of E. F. Houghton Co., 303 West Lehigh Ave., Philadelphia, Pa. 599 pp; price, $3.50.*

The fifth edition of this metallurgical handbook brings the volume up to date since its last revision in 1943. The latest standards and practices being followed in industry are presented, and it includes a discussion of future probabilities relating to new metals, new alloying elements and new types of heat-treatment. The sections on heat-treating are extensive and very complete.

The 120 pages which have been added to this new edition include new chapters on flame and induction heating and on other surface hardening methods. The chapter on heat-treating aluminum alloys has been expanded and renamed so as to include magnesium and copper alloys in addition to aluminum. The latest AISI steel classifications have been added, and the revisions also incorporate the most recent data relating to all phases of metallurgy.

ENGINEERING MATERIALS, *by Joseph Marin. Published by Prentice-Hall, Inc., New York. 491 pp; price, $8.70.*

Developments during recent years have made it necessary for the engineer to consider more carefully the properties of materials used in design and construction work. The mechanical properties of both old and new materials are assuming more and more importance as new inventions and new uses for old materials come into use. The objective of this text is to provide information concerning the properties of stressed materials so that intelligent selection and use of these materials may be made.

The mechanical properties of materials, their definition, determination and utilization are treated in Part I. Part II contains a brief treatment of a number of the more important engineering materials. Emphasis is on their mechanical properties. Part III contains information concerning testing machines for determining these properties of the various materials.

PERSONNEL ADMINISTRATION, *by William W. Waite. Published by The Ronald Press Co., 15 East 26th St., N.Y. 10. 683 pp; price, $7.*

This text covers the fundamental philosophies of personnel administration as they have evolved during the past fifty years, and shows how these fundamentals find continual expression in specific practical administrative methods and techniques. It shows how the demonstrated ability present in industry has been able to solve the complex problems of employing, training and administering the work force by a combination of adaptability, common sense and a growing understanding of human relations.

The approach used here is the illustrative method. Numerous problems are cited and the solutions given for these specific instances. The methods and fundamental principles can be derived from these much more easily than when presented in the abstract form. The instances cited are actual problems which have arisen in various industrial and business concerns.

The book also includes an extensive bibliography which includes collateral readings in books and periodical literature on the subject.

SAMPLING INSPECTION BY VARIABLES, *by Albert H. Bowker and Henry P. Goode. Published by the McGraw-Hill Book Co., Inc., 330 West 42nd St., N.Y. 36. 216 pp; price, $5.*

The book presents a comprehensive set of sampling plans for use when inspection of an item is by variables and the lot is to be evaluated in terms of its percentage defective. These plans can be used by industrial and business concerns for acceptance sampling inspection of purchased products, parts and raw materials; for sampling inspection of goods in process within a plant; and for sampling inspection of outgoing products.

Plans are included for use when the standard deviation of the product is not known, for use when it is known, procedures for use with two-sided specification limits, and a scheme utilizing both variables and attribute plans. Illustrative examples are included and the appendix contains practical computing techniques and graphical methods of applying the acceptance criteria which minimize the routine calculations required.

The general principles of sampling inspection by variables, the general properties of the plans, the construction of standard plans and standard procedure, and the mathematics of sampling inspection by variables are covered in the theoretical parts of the book.

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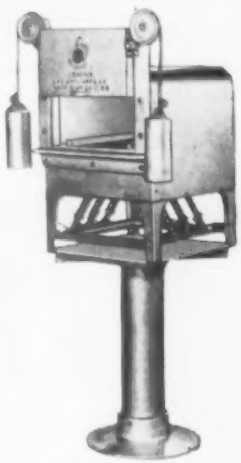

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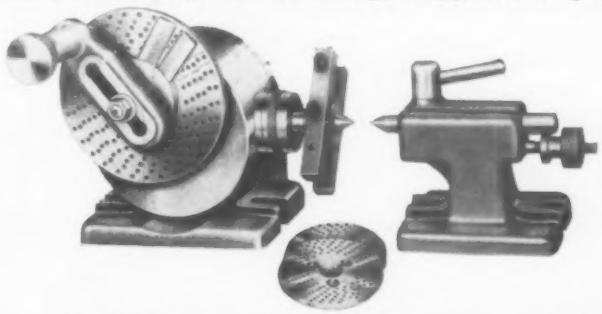

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Technical Shorts..

THE DECIDED INCREASE in demand for industrial diamonds—particularly crushing bort for grinding wheels—has brought about a growing threat to national economy and defense. The result has been to spur a nationwide program for their conservation and reclamation under the direction of the Salvage Division of the National Production Authority.

In outlining its program, NPA points out that the present need well exceeds the supply; therefore thrift in use and care is of prime importance in order that volume and quality of carbide-tipped cutting tools, vital to the metal-working industry, be maintained.

Five steps aimed at prolonging life are recommended to users:

1. Strictly control initial use of diamond wheels, including rigid tool crib control and proper wheel application to the job to insure maximum grinding efficiency per carat of diamond.

2. Strictly control use of diamond-tipped tools.

3. Personnel training in proper operation of grinding wheels and cemented-carbide tools in accordance with suppliers' advice.

4. Use other abrasives whenever application permits.

5. Mount diamonds in the tool shank to take advantage of the crystalline orientation of the stone.

In addition, NPA recommends a set of practices which it assures industry will save as much as 50 percent of the bort:

1. Back off the steel portions of carbide-tipped tools on aluminum oxide grinding wheels to avoid grinding of steel by the diamond wheel.

2. Prepare and rough grind the cemented-carbide tools on silicon-carbide wheels.

3. Check spindles to keep them true and operating within close limits.

4. Mount diamond wheels with extreme care to assure that back plates, flanges and spindles are clean, free from burrs or nicks and running true.

5. Follow wheel manufacturers' speed recommendations.

6. Use diamond grinding wheels only when they are in excellent operating condition—cleaned and dressed.

7. Use metal- or vitrified-bonded diamond wheels instead of resinoid for off-hand grinding.

8. Grind wet whenever possible, for this permits a diamond bort saving of approximately 30 percent over dry grinding.

9. Use a generous flow of coolant whenever practicable; otherwise use a mist coolant.

10. Grind cemented carbides on separate machines to keep diamond-wheel sludge separate from other sludges.

Still a few other pointers are mentioned to help the user make the most of his diamonds. Wet grind should be used whenever possible, for greater percentage of diamonds is saved in wet than in dry grinding. At the same time it is possible to salvage the maximum amount of bort during wet grinding operations. Swarf and sludge, NPA stresses, are valuable sources of salvage. Diamonds lost during operation of grinding wheels either crack up or shatter in use or are pulled from the bond which holds them in place, and can be reclaimed for re-use. In many cases the supplier will make reimbursement for reclaimed diamonds returned to him.

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RESULTS OF TESTS made recently by the National Bureau of Standards may be of considerable interest to many in the industry who are concerned with stainless steels in their operating setups.

The studies came about following the recognition of the fact that stainless steel used in aircraft exhaust systems were tending to absorb carbon under severe operating conditions. The possible failures of exhaust parts due to precipitation of carbides at or near grain boundaries as a result of this phenomenon made imperative the use of some preventative measure.

Several NBS ceramic coatings were applied to samples of 18-8 stainless including AISI types 304, 321 and 347. Then, together with some uncoated specimens, they were subjected to strongly carburizing conditions at 1350, 1500 and 1650 deg F. After four hours at the particular temperature chosen for the given test, the box was removed from the furnace and allowed to cool in the air.

Treated specimens then were examined for significant changes in surface appearance. Later they were sectioned, etched and examined metallographically. Researchers found that although some of the coated specimens showed blistering, spalling or wrinkling, metal never became exposed. Most of the uncoated specimens gave evidence of carbon absorption to depths as great as 0.008 in. below the surface they noted, while in most cases the ceramic coatings completely prevented absorption. A comment here might be that the extreme severity of the test probably would never be encountered in practical operation, and any of the coatings might prove fully satisfactory. Of the coatings tested, NBS ceramic coating A-19H proved most effective.

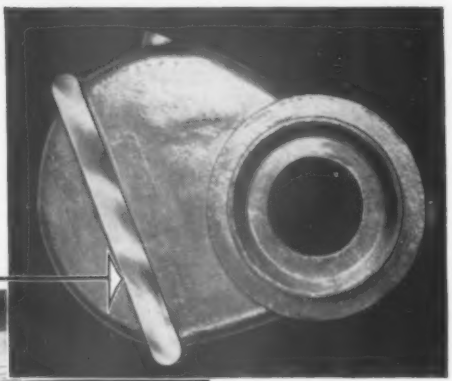
* * *

IN ANOTHER STUDY by the National Bureau of Standards, a similar search was made to find the best protective coating for molybdenum to protect the metal from rapid oxidation under very high temperatures during operation. The high melting point (4750 deg) of molybdenum suggests its use for a number of applications; specifically it offers possibilities for use in aircraft jet engines. Results of a study of a coating composed of chromium and frit (glass) indicated that such coatings greatly extend the useful life of molybdenum at high temperatures.

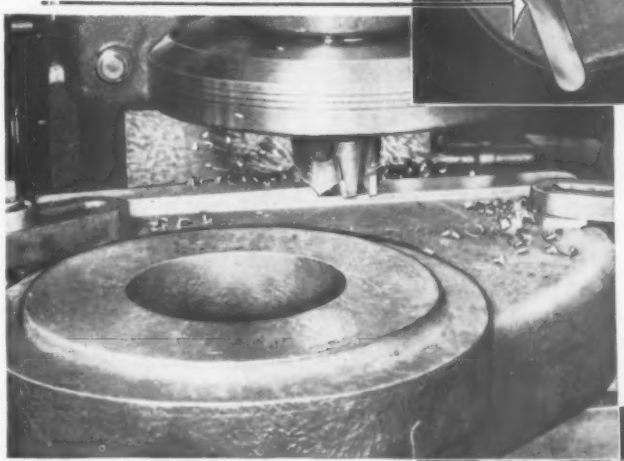
Various chromium-frit coatings were bonded to molybdenum specimens, then subjected to oxidation tests under tension in the range 1500 to 1800 deg F, and to flame tests in the 2000 to 3000 deg F range. At the lower heat, the coated specimens lasted for 1000 to 3000 hours. At 2800 deg F. with no

CUTS ARMOR PLATE LIKE BUTTER

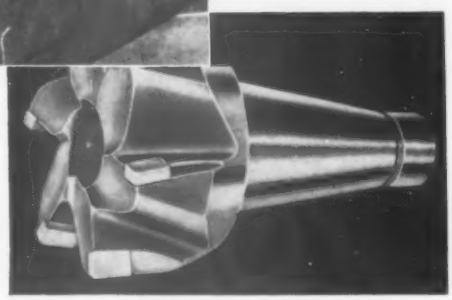
PHENOMENAL END MILL PERFORMANCE ON BULLET-PROOF TANK ARMOR PLATE



PROBLEM: MILL 23½" x 2¼" SURFACE OF TANK CARRIER! The material — the toughest armor plate casting yet devised for military purposes! An impossible operation with other types of cutters tested.



SOLUTION: STOCK REMOVAL ⅜" to ½" IN 3 CUTS — Finished surface parallel within .002 — NO REJECTS! A smooth machine like finish at 10½" per minute.



AND HERE'S THE NELCO TOOL THAT SOLVED THIS VITAL DEFENSE BOTTLE NECK! The *rugged* virtually *indestructible* NELCO Taper Shank End Mill — A 4" carbide tipped cutter that literally chews away half an inch of the toughest alloy Armor Plate America has produced — leaving a smooth, accurate machine-like finish.

Another of the *impossible* machining problems solved by NELCO tools and the Engineering advice of NELCO Field Engineers. Nelco cutters not only *save money* — they *make money* by performing costly machining jobs in newer ways — better ways!
Write for catalog and details on this husky NELCO TAPER SHANK END MILL and the hundreds of other NELCO Engineered Carbide Tools.— TODAY!

NELCO TOOLS — For that Extra Edge in Production

NELCO TOOL COMPANY, INC., MANCHESTER, CONNECTICUT

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...the word from the wise in milling cutter circles

The modern Lovejoy line of inserted-tooth milling cutters are ordered and reordered on the basis of performance. Proof? . . . our first customers are still with us after 30 years of satisfaction.

The modern Lovejoy line has never been more complete. Improved new designs, both standard and special, are coming constantly from our large engineering staff.

The modern Lovejoy line features the exclusive "positive-locking" device to allow maximum use of each blade and minimum loss in sharpening.

The modern Lovejoy line of milling cutters, boring tools, arbors, flywheels, etc., plus outstanding field service, can help you cut your production costs, just as it has for others.

131 MAIN ST., SPRINGFIELD, VERMONT

WRITE FOR FREE CATALOGS

LOVEJOY TOOL COMPANY, INC.

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load applied, protection was attained for as much as seven hours.

During the research, molybdenum specimens were coated with one of several powdered chromium-bearing base coats. Some of these contained a percentage of frit. After firing of the base coat, either in a hydrogen or an argon atmosphere a ceramic seal coat containing no chromium was applied to some of the specimens. Most durable coatings seemed to result from application of a glass-free chromium base coat followed by a glass seal coat. However, the coating which showed the highest durability of all investigated was that which contained yet a third coat which consisted of lower-melting glass.

Examination by microscope shows that the chromium of the base coat has a porous nature, formed by the diffusion-welding of the chromium particles to each other and to the molybdenum base. During the firing of the seal coat, the glass is absorbed into this structure. Further, the researchers report that even though thermal strain and rapid creep tend to cause cracking of the coatings, adherence is excellent and the glassy layer tends to reseal the fissures; thus cracking does not bring about rapid failure.

* * *

A COLOR FEATURE "The Vertical Turbine Pump Story" has been released by Worthington Corp. The film contains 165 slide frames on continuous 35 mm strip and is synchronized to a 20-minute narration. Purpose of the film is to combat habit, continued through lack of acquaintance with the vertical pump, which the company feels has made many engineers continue to select other types of pumps less economical in cost and floor space and less simple in installation for situations to which the vertical turbine is best suited. It points out the main characteristics of the newer designed pumps and also goes into the operations related to their production.

* * *

THE METALS SHOW will be the scene of the first showing of a 22-minute color movie "No Finer Electrodes Made . . . Anywhere" by Alloy Rods Co. The film, which endeavors to tell the inside story of how arc welding electrodes are manufactured, is aimed at acquainting persons both inside and outside the field with the "how's" and "why's" of their manufacture.

Proceeding from the initial cold drawing of hot rolled rod, the picture goes through the research and quality control steps and on to the final packing of the finished product. A narrator interprets what is going on in easily understandable terms.

TRADE LITERATURE

Free Booklets and Catalogs Currently Offered By Manufacturers

Abrasive, Diamond

Eight page booklet deals with the efficient application of diamond abrasives; contains basic information on the characteristics of diamond as an abrasive. Also includes complete catalog data on Elgin diamond abrasive, Dymo, and the Dymo finishing accessory line. Abrasive Division, **Elgin National Watch Co.**, Elgin, Ill. **L-10-1**

Gear Finishing

Illustrated bulletin describing the recently developed model Bm-2055 Burr-Master for chamfering Zerol bevel gears. Included in the bulletin are complete descriptions of the operating cycle and work mounting fixture as well as construction details and specifications. **Modern Industrial Engineering Co.**, 14230 Birwood, Detroit 4, Mich. **L-10-2**

Cemented Carbides

Technical data on cemented carbide products are included in catalog No. 52 which covers company's lines of standard and special tools. There is a discussion of grade selection and classification, machining speeds, description of properties, and tool wear analysis. **Kennametal Inc.**, Latrobe, Pa. **L-10-3**

Materials Handling

Recently-revised 28-page catalog of Rapistan conveying equipment presents photos, drawings, and specifications of an enlarged line of power and gravity conveyors, hand trucks, and industrial casters. Several new equipment models also are shown. **The Rapids-Standard Co., Inc.**, Grand Rapids, Mich. **L-10-4**

Formed Curved Shapes

Bulletin on engineered structural shapes discusses rolled or formed angles, beams, channels, bars, and rails of steel, aluminum or brass emphasizing time and money savings. **Kling Bros. Engineering Works**, 1321 N. Kostner Ave., Chicago 51, Ill. **L-10-5**

Silicones

A new edition of "Silastic Facts" No. 10a provides a detailed discussion of Dow Corning silicone rubber. Describes the characteristics of these semi-organic elastomers, devoting separate sections to their resistance to high and low temperatures, to weathering, chemicals and hot oils, to compression set and thermal aging, and to their dielectric properties. **Dow Corning Corp.**, Midland, Mich. **L-10-6**

Graphite Coatings

Illustrated six-page bulletin (No. 435), titled "Colloidal Graphite for Surface Coatings and Impregnation," describes new uses for electric furnace graphite of high purity as a dry-film lubricant; also discusses its application as an impregnating medium for a variety of materials. **Acheson Colloids Co.**, division of Acheson Industries, Inc., Port Huron, Mich. **L-10-7**

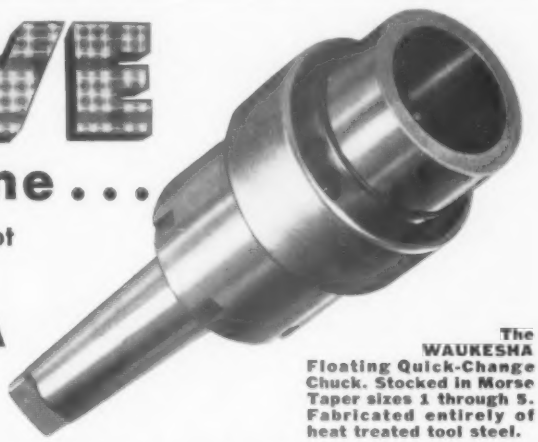
Surface Grinding

Sixty-page booklet contains helpful information for users of abrasive discs on surface grinding operations. Contents include abrasive fundamentals, selection information, types available, standard markings, spindle speeds, coolant selection, dressing, safety, grinding various materials and care of discs. Widely illustrated. **Gardner Machine Co.**, Beloit, Wis. **L-10-8**

SAVE set-up time . . .

Cut true holes in pilot runs with the NEW

WAUKESHA Floating QUICK-CHANGE CHUCK



The WAUKESHA Floating Quick-Change Chuck. Stocked in Morse Taper sizes 1 through 5. Fabricated entirely of heat treated tool steel.

Your set-up time is greatly reduced with the WAUKESHA Quick-Change Chuck because correct alignment of your cutting tool is not required. The built-in Floating Holder gives you instant and positive parallel alignment up to .030" at any point within 360°. No trial and error in your pilot or production runs.

Changing tools is quick and easy. Simply lift a locking ring which releases two steel driving balls — seat the new tool — snap the ring down — and you're ready to go. No springs to weaken or break.

Cut your shop costs. Order this efficient "two-in-one" tool from WAUKESHA — today.

Other Money Saving WAUKESHA Tools

WAUKESHA manufactures a complete range of adjustable, inserted blade cutting tools: reamers, spade drills and special tools for individual requirements. You save money with WAUKESHA Tools for you replace only the blades; the tool bodies last for years.

Like your safety razor — you replace only the blades in WAUKESHA Adjustable, Inserted Blade Tools.

Send for the *new*, complete, illustrated WAUKESHA Tool Co. catalogue. Gives full specifications and prices. A post card will bring it promptly. Write today.

WAUKESHA TOOL CO.

1428 Arcadian Ave.
WAUKESHA, WIS.

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Bronze Bearings, Bars

Stock catalog 52, covers line of company's products and services; also includes engineering data on qualities of various types bearings, installations, operating principles and machining information. Illustrated. **The Bunting Brass & Bronze Co.**, Toledo 1, Ohio. **L-10-9**

Steel

Four-page folder on Desegatized, high-speed steel, Electrite HV-6, covers typical analysis, hardening and tempering data; illustrated by tables and graphs. **Latrobe Steel Co.**, Latrobe, Pa. **L-10-10**

Tools, Hand, Hydraulic

Comprehensive job-picture book shows how hydraulic tools can solve production, construction, maintenance and other problems. Called the "Idea Book", it can be obtained from **Blackhawk Mfg. Co.**, Milwaukee 1, Wis. **L-10-11**

Motor Drives

Bulletin describes "Allspeed" motor drives of from ⅓ to 7½ horsepower; upright and horizontal drives of either closed or skeleton types are pictured. **Worthington Corp.**, Harrison, N. J. **L-10-12**

Only **MARVEL** *builds all four**

*HACK SAWING MACHINES
*BAND SAWING MACHINES
*BAND SAW BLADES
*HACK SAW BLADES

While it is true there are several builders of hack sawing machines and many builders of band sawing machines, only MARVEL builds BOTH hack saws and band saws. The fact is that MARVEL manufactures 35 models of 10 basic type of metal sawing machines which include the world's fastest automatic production saw, the world's largest giant hydraulic hack saws, the world's most versatile band saw and the most widely used small shop saws.

With intimate and broad field experience in all types of metal cutting-off equipment and 35 different saws available, it is obvious that MARVEL Field Engineers occupy a unique and exclusive position in the industry. They are eminently qualified to make expert and unbiased recommendations covering the type, size and model of metal sawing equipment best suited to individual requirements—that most efficient, most accurate, fastest, broadest in scope and the most economical.

MARVEL is also the only manufacturer of both metal sawing machines and metal sawing blades. Because the efficiencies of both the machine and the blades are interdependent, each upon the capability of the other, expert knowledge covering both saws and saw blades is essential to the proper appraisal of any specific sawing situation. Correct balance of cutting speed and blade life, feed pressure and blade tension are all potent factors in over-all performance. Here again it is the MARVEL Field Engineer who is qualified to provide the comprehensive answer to your question. His job is to help you saw metal most efficiently—his services are available upon request—gratis.

WRITE FOR CATALOG 49

ARMSTRONG-BLUM MFG. CO.

5700 Bloomingdale Ave., Chicago 39, U.S.A.

MARVEL Metal Cutting SAWS
No. 9A Marvel Hack Saw
No. 8 Marvel Band Saw
MARVEL High-Speed-Edge HACK SAW BLADE
MARVEL Metal-Cutting BAND SAW BLADE

FOR FURTHER INFORMATION; USE READER SERVICE CARD; INDICATE A-10-136

Measurement, Optical

Illustrated catalog 30 describes an optically precise level for measuring flatness, straightness, and parallelism, and for checking and leveling machine beds, surface and lapping plates, ground and rolls, jigs, fixtures, airframes and dozens of similar applications. **F. T. Griswold Mfg. Co.** W. Lancaster Ave., Wayne, Pa. **L-10-13**

Nickel Alloys

Two booklets list and summarize helpful publications in the nickel field. List "A" contains literature on nickel alloy steels, stainless steels, nickel cast irons, nickel brasses and bronzes, and nickel plating. List "B" covers literature available on Monel, "R", "K", "KR" and "S" Monel, nickel, Duranickel, low carbon nickel, Inconel, Inconel "X," and Incoloy. **The International Nickel Co., Inc.**, 67 Wall St., New York, N. Y. **L-10-14**

Steel, Tool and Die

Bulletin on Ry-Die, a 5 percent chromium type air hardening tool and die steel, gives chemical analysis, hardening characteristics, wear resisting properties, as well as instructions for heat treatment, and also lists typical applications. **Joseph T. Ryerson & Son, Inc.**, P. O. Box 8000-A, Chicago 80, Ill. **L-10-15**

Coating for Steel

A phosphate coating and lubricating process, which makes possible the cold extrusion and forming of steel, and is applicable to both carbon and stainless steels, is fully described and illustrated in an 8-page booklet available from **Dextrex Corp.**, Box 501, Detroit 32, Mich. **L-10-16**

Switches

Brochure, No. 82, covers safety, limit and interlock switches designed especially for switching a-c circuits in industrial and commercial applications; gives complete information on each switch including description, dimensions, mechanical characteristics, electrical characteristics, and electrical capacities. **Micro Switch, Div.** of **Minneapolis-Honeywell Regulator Co.**, Freeport, Ill. **L-10-17**

Fasteners

Information on industrial fasteners for metal-to-metal and metal-to-wood applications is contained in a 22-page handbook. Blind rivets and a variety of door latching and fastening devices are illustrated. Installation procedure, sample applications and complete dimensional information are given for all types fasteners. **Southco Div., South Chester Corp.**, Lester, Pa. **L-10-18**

Level Measurement
Four-page folder describes 15-in. precision level; includes actual-size photo as well as various illustrations of instrument in use. Text discusses main features. **Pratt & Whitney, Div. Niles-Bement-Pond Co.,** West Hartford 1, Conn. **L-10-19**

Compressors, Air
Two-stage, air-cooled radial air compressors capable of producing 80 to 125 pounds pressure are described in 12-page bulletin. Dimensions, weights, capacities, sizes, general specifications and cross section photographs are included. **Worthington Corp.,** Harrison, N. J. **L-10-20**

Components, Mechanical
Sixteen-page illustrated brochure (MD A-200) describes the complete line of precision components for rapid and economical breadboard and semi-permanent assembly of control systems instrumentation and analog computers. Photos and engineering drawings accompany text. **Servomechanisms, Inc.,** Post and Stewart Aves., Westbury, Long Island, N. Y. **L-10-21**

Gear Cutting
Illustrated handbook "Cutting Gear Teeth on a Milling Machine" has been revised and enlarged. Includes information on milling rack teeth; spur, bevel, and helical gear teeth; and worms and worm wheels as well as tabulated reference data. **The Cincinnati Milling Machine Co.,** Cincinnati 9, Ohio. **L-10-22**

Seals
"O-Rings . . . Design, Manufacture and Application" is a 16-page illustrated booklet giving brief but comprehensive data on manufacture and application of "O-Rings" as static and dynamic seals. International Packings Corp., **Graton and Knight Affiliate,** Bristol, New Hampshire. **L-10-23**

Inspection
Four-page folder, "Seven Industrial Eyes," describes seven types of X-ray equipment made by Westinghouse for industrial application. Folder contains pictures of each type of X-ray equipment with a brief description of how each is used. **Westinghouse Electrical Corp.,** 401 Liberty Ave., Box 2278, Pittsburgh 30, Pa. **L-10-24**

Wet Blasting
Fully illustrated six-page brochure titled "Wet Blasting in Precision Finishing" shows parts both before and after wet blasting; also shows some typical installation photographs of parts being cleaned. Bulletin No. 43, **American Wheelabrator & Equipment Corp.,** Mishawaka, Ind. **L-10-25**

Solve Threading Problems on Die Castings . . . with

REED R.T.D. CYLINDRICAL DIE THREAD ROLLERS

Smooth, precise threads rolled on die cast parts . . . 1200 to 1800 per hour

Thread rolling is now accepted as the preferred method of producing uniform, accurate threads with smooth flanks on die castings. Most of the materials commonly used in die casting permit the threads to be more accurately formed by rolling than by other processes. Production efficiency is higher and thread rejections are rare. Quality control is simplified and inspection is limited usually to spot checking, even on the most precise threads.

Automatic hopper feeds are available for large production runs and where it is desirable for one operator to run several machines.

Send us specifications of your requirements and let us supply you with complete information.

REED ROLLED THREAD DIE CO.

Manufacturers of

THREAD ROLLING MACHINES and DIES • KNURLS • THREAD ROLLS

Worcester, Massachusetts, U. S. A.

TE 024

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North East West South IN INDUSTRY

Three changes in the technical staff recently announced by **Hy-Pro Tool Co.** included the appointment of **Harvey F. Phipard, Jr.** to the position of director of research and engineering; Edward J. Locke, Jr. was appointed to the position of chief engineer, and **George E. Jenney, Jr.** was named master mechanic.

Announcement of **Kendall C. White** as production manager of the company has been made by **Wico Electric Co.** Mr. White, who only recently was released from active duty with the U. S. Army Signal Corps, will be responsible for all planning, scheduling, production control, material and inventory control at the Wico plant.

Are you having TROUBLES in your DRILL DEPARTMENT?

Following are some of the most common and their causes:

Trouble	Cause
Oversize holes.	Unequal lip length.
Drill burns—will not cut.	Insufficient clearance.
Cutting edge chips or crumbles.	Too much clearance.
Outer corners of lip break down. Excessive wear on margins.	Speed too High.
Rough holes. Drill breakage. Drill point crushes.	Speed too slow or Feed too heavy.
Broken tangs.	Dirt or chips in socket or worn out socket.

Most of the above can be overcome by using a precision type Drill Grinder. A Hisey Drill Grinder will quickly pay for itself when you consider that drills that are correctly ground and kept sharp will (1) drill faster, (2) drill more holes per grind, (3) drill to exact size, (4) reduce breakage, (5) increase life of drill by removing less metal when sharpening.

A Hisey Drill Grinder will grind drills quickly and correctly with inexperienced operators.

ASK FOR CATALOG 72 EB

It shows more than 200 different types and sizes of Bench and Pedestal Grinders, Buffers and Polishers, Snagging Grinders, Lathe type Grinders, Wet Tool Grinders, Disc Grinders and Dust Collectors.

Hisey **THE HISEY-WOLF MACHINE CO.**
CINCINNATI 8, OHIO
Division of The Cincinnati Electrical Tool Co.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-138

Milton F. Beecher, head of Norton Company's research and development laboratories since 1941, has retired as vice-president and director. During his 37 years with the company, Mr. Beecher was responsible for the guidance and direction of many important Norton inventions and developments. A pioneer in ceramic engineering, he has authored nine publications in that field and shares ownership in 21 patents. Mr. Beecher is succeeded by **Wallace L. Howe**, director of research and development.

Milton F. Beecher

Arthur M. Stoner

The Franklin Institute has announced that its Certificate of Merit has been awarded to **Arthur M. Stoner**, vice-president of **The Jacobs Manufacturing Co.**, for his development of a chuck and collet combination for lathes to hold cylindrical work being machined. Formal presentation will be made at the Institute's Medal Day ceremonies October 15. The citation accompanying the Certificate states the award is being given Mr. Stoner "in consideration of his achievement in producing outstanding advantages in the development of machine tool chucks resulting in an improved device known as the spindle nose lathe collet chuck."

Mr. Stoner began his work in the Jacobs organization, which was founded by his grandfather, as an engineer in 1931. Later, as chief engineer, he carried on an extensive research and development program. In order to devote more time to development work, he was appointed to his present position in 1944. Most of the 60 patents granted Mr. Stoner cover tools or methods for their manufacture.

H. F. Kluender has been named secretary-treasurer and director of **Visi-Trol Corp.** Mr. Kluender approaches his new position with three years' experience as sales manager of the firm. Previously he was vice-president and general manager of The Detroit Alloy Steel Co., and later held those same titles with Detroit Gray Iron Foundry Co. when the two organizations merged.

James **H. Lowe** has been named product development director of **Steel Founders' Society of America.** A veteran proponent of product engineering advances in the foundry industry, Mr. Lowe formerly was technical and research director of Wehr Steel Co.

M. C. **Nelson** has been promoted from general manager of **Barksdale Valves, Inc.** to the position of vice-president and director of the organization. In this capacity, he will direct the Barksdale sales and service activities.

According to announcement recently made at **Borg-Warner Corp., Carl R. Freberg** has been appointed assistant director of the company's research laboratory in Bellwood, Ill. Dr. Freberg, who formerly was head of the Equipment Research Department of the Naval Civil Engineering Research and Evaluation Laboratory at Port Hueneme, Calif., is the author of two books, *Elements of Mechanical Vibration* and *Aircraft Vibration and Flutter*, in addition to numerous articles on mechanical engineering subjects.

At its quarterly board of directors' meeting, **Harold F. Keyes, Jr.** was elected an assistant secretary of **Brown & Sharpe Manufacturing Co.** Mr. Keyes, who became associated with Brown & Sharpe at the beginning of last year, has worked first as comptroller of the Greystone Division, and later in treasury functions at the main plant.

Eugene V. Ivanso is the new head of metallurgical engineering and research at **Detroit Testing Laboratory.** Mr. Ivanso comes to the Laboratory with 16 years of experience in the field accumulated during his association as an engineer with Bundy Tubing Co., Wyandotte Chemicals Corp. and Steel Sales Corp.

According to recent announcement at **Allis-Chalmers Manufacturing Co., William M. Terry, Jr.** has been appointed assistant chief engineer at the Pittsburgh Works. Mr. Terry, who joined the company in 1947, has been active in promoting its power transformer design program.

Joseph W. Harrison has been made technical staff assistant of the Works Managers department of **Arma Corp.** a subsidiary of American Bosch Corp. Selection of Mr. Harrison for the position stemmed from his wide experience as chief inspector, Norge Machine Products Division of Borg-Warner Corp.

John W. Queen has been appointed manager of the Cleveland plant of **Joseph T. Ryerson & Son, Inc.** Mr. Queen, who joined the company's sales staff in 1933, has served as manager of the alloy steel department and, more recently, as manager of the alloy steel division with responsibility for alloy steel sales at all Ryerson plants.

At the same time J. C. Garrett, president of the firm, announced the appointment of **B. N. Snow** as a vice-president and director to work directly out of the president's office on special assignments. **W. J. Pattison** was named director of sales and service of the AiResearch Manufacturing Co. division. Mr. Snow formerly was vice-president in charge of sales of the AiResearch Manufacturing division, while Mr. Pattison has been assistant to the president.

W. C. Whitehead was elected executive vice-president of **The Garrett Corp.** during a recent meeting of the board of directors. In his new position, Mr. Whitehead, who has been acting general manager since last spring, will assume some of the company's top administrative duties. In addition he will retain his position as manager of the corporation's Airsupply division.

Bowser Technical Refrigeration Division of **Bowser Inc.** has named **William H. Miller** as chief metallurgist. In announcing the appointment, Stephen V. Zavoico, president of Bowser, said that Mr. Miller was joining the organization in order to conduct intensive research into cold treatment of metals and its practical application to all metalworking and metaltreating industries. He also will function as plant metallurgist in selection of materials and metallurgical procedures.

OBITUARY

Paul B. Greenawald, vice-president in charge of production and a director of The Carpenter Steel Co. died recently. Mr. Greenawald, who was 58 years old, had been associated with Carpenter since 1924.

NEW boring tool set
by PORTAGE
Quick Change
FOR
• BORING MILLS
• TURRET LATHES
• MILLING MACHINES
P. D. Q.
(Portage Double Quick)
Featuring the new...
.... TRIPLE lock grip
Portage Holders
No. 4, 5, 6, Morse Tapers
No. 40 & 50 Milling Machine Tapers
Holders designed to fit any application.
PORTAGE opens a new era in Quick Change Tools. Tapered contact with the new TRIPLE LOCK, assures faster tool change, positive repositioning, greater rigidity and longer wear life. A really COMPLETE set for BORING, MILLING and TURRET LATHE use. Also supplied (if desired) is a wooden rack especially designed for the set.
If you have not seen this . . . proved on the job set . . . write for details NOW.
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EASIER-FASTER
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FLEXIBLE SHAFT MACHINES

TAPPING ATTACHMENTS
TAPS · FLEXIBLE SHAFTS
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ROTARY FILES
TUNGSTEN CARBIDE
REAMERS AND MILLS
DRILLS · BORING BITS

Whether your operations call for GRINDING, CUTTING, BUFFING, or ROTARY FILING, Jarvis Flexible Shaft Machines will do your jobs Easier—Faster and more economically.

Available in Bench, Floor or Overhead types—in Single or Multiple Speeds to suit your individual requirements.

Jarvis Factory trained representatives are ready to assist you select the Machines you need. For further information and Catalog of Jarvis Flexible Shaft Machines, write directly to The Charles L. Jarvis Company, Middletown, Connecticut.

Jarvis POWER TOOLS

THE CHARLES L. JARVIS CO.
MIDDLETOWN IN CONNECTICUT

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Abstracts of Foreign Technical Literature

By M. Kronenberg

Great Britain: The prevention of scuffing of machined surfaces is a problem which has claimed the attention of tool engineers for many years. It is known that scuffing can be prevented by care in machining and particularly by initial running-in, whereby adequate lubrication is a prerequisite. A new method of treating such surfaces which renders them more resistant to scuffing is discussed by H. G. Davis in the British edition of *Machinery*. It consists in applying a dispersion of colloidal graphite ("dag") in a volatile medium which, on drying, leaves a coherent, oil-resisting graphite film. This film prevents metal-to-metal contact. It is claimed that the method of coating pistons and other workpieces is very simple. The colloidal graphite can either be sprayed on the degreased surface or the workpieces can be dipped into the graphite. A temperature of about 200 deg F is required for fast drying, which can, however, also be achieved at normal room temperature in the course of several hours. The coating has a low coefficient of friction and an affinity for oil which is greater than that of the bare metal. Thus the oil film spreads more rapidly which is of importance in preventing scuffing.

Speed, simplicity, flexibility and power amplification are the chief advantages of pneumatic operation of clamping devices, work feeding and effecting mechanisms, operation of control levers and driving of machine spindles at super high speeds. However, as pointed out by H. C. Town in the British edition of August 7 of *Machinery* one limitation of pneumatic power is that high pressures are not readily attainable, and—with the usual plant pressure of about 80 lbs per sq. inch—cylinder diameters may become prohibitively large for some purposes. Air is also unsuitable as a precision feed medium owing to its compressibility. Controlled speed is possible with air cylinders but not against varying resistance, whereas hydraulic systems will permit steady movements at adjustable rates. On the other hand, compressed air is the better medium where speed is required since its velocity may be far greater than for fluids. While 8 to 15 ft/sec is the aver-

age velo[illegible]y of oil flow, that of air may be take[illegible]s high as 600 ft per sec at 80 lbs[illegible] in. The author gives a great number [illegible] other examples for comparison of [illegible]neumatic and hydraulic systems, d[illegible]cussing very thoroughly cylinder a[illegible]gements, control valves, jig and fix[illegible]re equipment, solenoid valves, power [illegible]quirements, pneumatic circuits and othe[illegible] such items.

Hitherto the general practice, when brazing small steel parts, has been to use either thin copper wire of such a gage as to supply just the amount of copper required, or copper foil cut to shape and inserted between the surfaces to be joined. As a new contribution to the solution of such brazing problems the wider use of metal powders is recommended by H. W. Greenwood in the issue of July 17 of the British edition of *Machinery*. This method is advocated for large or small parts of steel, cast iron, malleable iron and other metals and alloys. The advantage of metal powder for this purpose is that it requires only to be made into a fairly stiff paste and can then be painted onto the surface to be brazed. Flux—when required—can be incorporated into the paste. A particular application of copper brazing powder is for mounting cemented carbide tips on steel shanks. A borax flux is used.

Switzerland: A European Conference has been held at Wetzlar, Germany, on the preliminary standardization of measuring systems of surface finish and roughness, in order to eliminate the existing international confusion, which is the result of three different bases used for such measurements.

While the "RMS" (root mean square) is the basis for surface data in the United States, England has adopted the mean arithmetic deviation from an idealized flat surface (known as CLA) and Germany the depth of roughness "R."

E. Bickel, reporting on the conference in the Swiss magazine *Industrielle Organization* No. 7, 1952 indicates that the German R- values were not found satisfactory by the Conference. They lack a sufficiently accurate definition of the units, while a nearly constant relationship of 1:1.1 to 1:1.3 exists between the British CLA values and the American RMS values.

Representatives from England, Holland, Austria, Switzerland and Germany agreed to recommend the British CLA-system, expecting the United States to adopt this basis also. In addition a new metric unit (the "ru") equal to 0.025 Micron (0.000 025 mm) was recommended because it is very nearly identical with the American "Micro-inch" (0.000 001" = 0.000 0254 mm) and thus will render it easier to convert from the metric system into the

Jarvis

SOLID TUNGSTEN CARBIDE TOOLS

INDUSTRIAL TOOLS FOR INDUSTRIAL USERS

PRECISION MACHINE GROUND

Quality

ROTARY FILES • REAMERS • BORING BITS • END MILLS

TAPS
TORQOMATICS
MULTI-TAPPERS
FLEXIBLE
SHAFT MACHINES

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THE CHARLES L. JARVIS COMPANY

MIDDLETOWN IN CONNECTICUT

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-141

MEASURE IN MICROINCHES RMS

Disc Production *increased over* 100%

because THE S. K. WELLMAN CO. uses the PROFILOMETER

The S. K. Wellman Company of Cleveland, Ohio, world's largest manufacturer of all-metal clutch facings and brake linings, was experiencing trouble in the manufacture of a special clutch disc for use in a vital aircraft production unit.

Specifications for this special clutch disc called for its manufacture to be exceedingly thin and with a surface finish of no more than 32 microinches r.m.s.

When the thin clutch discs were first put into production, Wellman experienced warping, burning and glazing during grinding and lapping. Production was low and scrappage was excessive. Some method, Wellman decided, was needed to increase production yet maintain specified tolerances.

Then Wellman turned to the reliance of the Profilometer.

With the Profilometer, Wellman production men found they were grinding and lapping the thin clutch discs far too smoothly—from six to ten microinches—thus causing the disastrous warping and burning. It was also found with the Profilometer that grinding and lapping time of the discs could be cut to a minimum due to accurate on-the-job surface measurement. Surface finish was held to the specified 32 microinches. And most important of all—scrappage was almost entirely eliminated and production increased over 100%.

This is just another example of the ever increasing use of the Profilometer as an important *shop instrument.*

To learn how the Profilometer can help cut costs in your production, write today for these free bulletins.

Profilometer is a registered trade name.

MICROMETRICAL MANUFACTURING COMPANY
formerly PHYSICISTS RESEARCH COMPANY
Instrument Manufacturers

ANN ARBOR 10 MICHIGAN

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inch system and vice versa. Other topics were concerned with defining more clearly the borderline between shape and surface roughness and with related problems.

Germany: The application of strain gages for measuring deflections, strains, torques, forces, vibrations etc. which has largely been pioneered in the United States is now also finding increasing interest in Germany as indicated by an article in the July issue of *Werkstattstechnik un Maschinenbau.* The authors, K. Fink and H. Mintrop, after discussing the basic principles of the Baldwin SR-4 strain gages give examples of the use of Swiss and Dutch made strain gages in the European machine tool industries. One of their investigations covers the determination of the rolling forces when cold rolling sheet metal, another one deals with measuring the energy required in the hot rolling of steel. A torquemeter has been developed for measuring the torque generated in pneumatic hammers.

The cutting force dynamometer, developed by Shaw and Loewen at the Massachusetts Institute of Technology, is critically analyzed, leading the authors to the conclusion that these and similar dynamometers have the disadvantage of exposing the strain gages to the chips, cutting fluids etc. To eliminate these drawbacks they follow a suggestion by O. Kienzle who designed an instrument to measure cutting forces by determining the torque at the face plate of a lathe rather than measuring the forces at the tool post. This device makes use of the elasticity of small bars, built in between the face plate and the workpiece. It seems to us that such an arrangement would yield satisfactory data only when the elastic bar does not change the gripping effect at the face plate in comparison with common machine shop practice.

Strain gages used for measuring the torque exerted by wrenches are likewise discussed in this article, which will be of interest to many tool engineers although the latest American techniques and instruments are not taken into consideration.

TITANIUM PRODUCTION ROLLS

Republic Steel Corp. has revealed that it now is producing titanium and its alloys at the Canton and Massillon, Ohio, steel plants. Republic, which is the largest steel company to announce that it is working on the new metals, said it has been supplying ingot, sheet, plate, strip, bar and wire forms for the past two years for aircraft and other defense programs. Production still is limited and is under strict government allocation.

Who's Meeting--and Where

Sept. 30-Oct. 3. ASSOCIATION OF IRON AND STEEL ENGINEERS. Annual convention in conjunction with 1952 Iron and Steel exposition. Cleveland Public Auditorium. Complete information from AISE headquarters, 1010 Empire Bldg., Pittsburgh 22.

Sept. 29-Oct. 1. NATIONAL ELECTRONICS CONFERENCE. Eighth annual conference, held under joint sponsorship of American Institute of Electrical Engineers, Institute of Radio Engineers, Illinois Institute of Technology, Northwestern University and University of Illinois, with participation by Purdue University, University of Wisconsin and the Society of Motion Picture & Television Engineers. Sherman Hotel Chicago. More details from NEC Publicity Committee, 208 W. Washington St., Chicago.

Oct. 3-5. SOCIETY OF INDUSTRIAL DESIGNERS. Annual meeting at Shawnee Inn, Shawnee on Delaware, Pa. Details from society's secretary, 48 E. 49th St., New York 17.

Oct. 9. AMERICAN IRON AND STEEL INSTITUTE. Regional technical meeting. William Penn Hotel, Pittsburgh. Contact 350 Fifth Ave., New York 1, for more facts.

Oct. 10. NATIONAL NOISE ABATEMENT SYMPOSIUM. Third annual symposium, Armour Research Foundation of Illinois Institute of Technology. Details from Daniel B. Callaway, chairman; address the Institute, Technology Center, Chicago 16.

Oct. 14-16. SOCIETY OF INDUSTRIAL PACKAGING AND MATERIALS HANDLING ENGINEERS. Annual exposition, Coliseum, Chicago. Contact society's headquarters, 20 W. Jackson Blvd., Chicago 4, for details.

Oct. 16-17. GRAY IRON FOUNDERS' SOCIETY, INC. Twenty-fourth annual meeting. Hotel Cleveland, Cleveland. Write society headquarters, 210 National City—E. 6th St. Bldg., Cleveland, for details.

Oct. 16-18. FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION. Annual meeting. The Greenbrier, White Sulphur Springs, W. Va. More information from association headquarters, Engineers Bldg., Cleveland 14.

Oct. 19-21. CONVEYOR EQUIPMENT MANUFACTURING ASSOCIATION. Annual meeting. The Greenbrier, White Sulphur Springs, W. Va. No. 1 Thomas Circle, Washington 5, can give details.

Oct. 20-22. PACKAGING INSTITUTE. Annual meeting. Hotel Commodore, New York. More complete information available from Institute headquarters, 342 Madison Ave., New York 17.

Oct. 20-24. AMERICAN SOCIETY FOR METALS. National Metals Show at Convention Hall, and annual meeting, Benjamin Franklin Hotel to be held concurrently, Philadelphia. Address society headquarters for facts (see above).

Oct. 26-29. AMERICAN GEAR MANUFACTURERS ASSOCIATION. Semiannual meeting, Edgewater Beach Hotel, Chicago. Contact AGMA headquarters, Empire Bldg., Pittsburgh 22, for details about program.

Oct. 29-31. AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Fifth annual machine tool Conference, Hotel Ten Eyck, Albany, N. Y. Additional information from J. J. Delfs, chairman, AIEE Machine Tool Sub-Committee, c/o General Electric Co., Schenectady 5, N. Y.

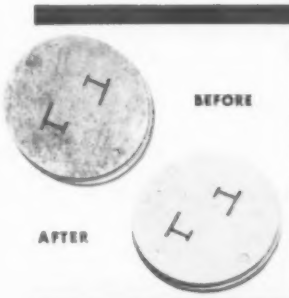
WHAT YOU CAN DO WITH A LIQUAMATTE

DIE FINISHING AND MAINTENANCE

Liquamatte wet blasting saves many tedious operations in both manufacture and maintenance of dies and molds. It provides a surface that is easily polished with finer papers. It blends directional polishing lines and produces a finish that will "wet" with lubricants and break-in quickly. Hydro-carbons, oxides and smeared metal are removed in seconds. The Liquamatte thoroughly cleans the surfaces and exposes all fatigue cracks and surface defects. It reduces redressing time.

TOOL FINISHING AND DEBURRING

Broaches, Hobs, Cutters, Drills and similar tools are finished with a Liquamatte in a fraction of the time consumed by hand methods. Wet blasting in a Liquamatte quickly removes the fine wire burrs formed by grinding on the cutting edges. It produces a thoroughly clean, scale-free surface that provides a firm bond for plating.



SCALE REMOVAL

Heat treat scale and discoloration are removed from precision parts while holding tolerances of .0001". The Liquamatte removes the average heat treat scale at the rate of approximately 75 to 100 square inches per minute when a $\frac{7}{32}$" air jet and a $\frac{1}{2}$" abrasive nozzle is used.

SEND FOR NEW BULLETIN No. 43

American LIQUAMATTE WET BLASTING

WHEELABRATOR & EQUIPMENT CORP.

856 S. Byrkit St., Mishawaka, Ind.

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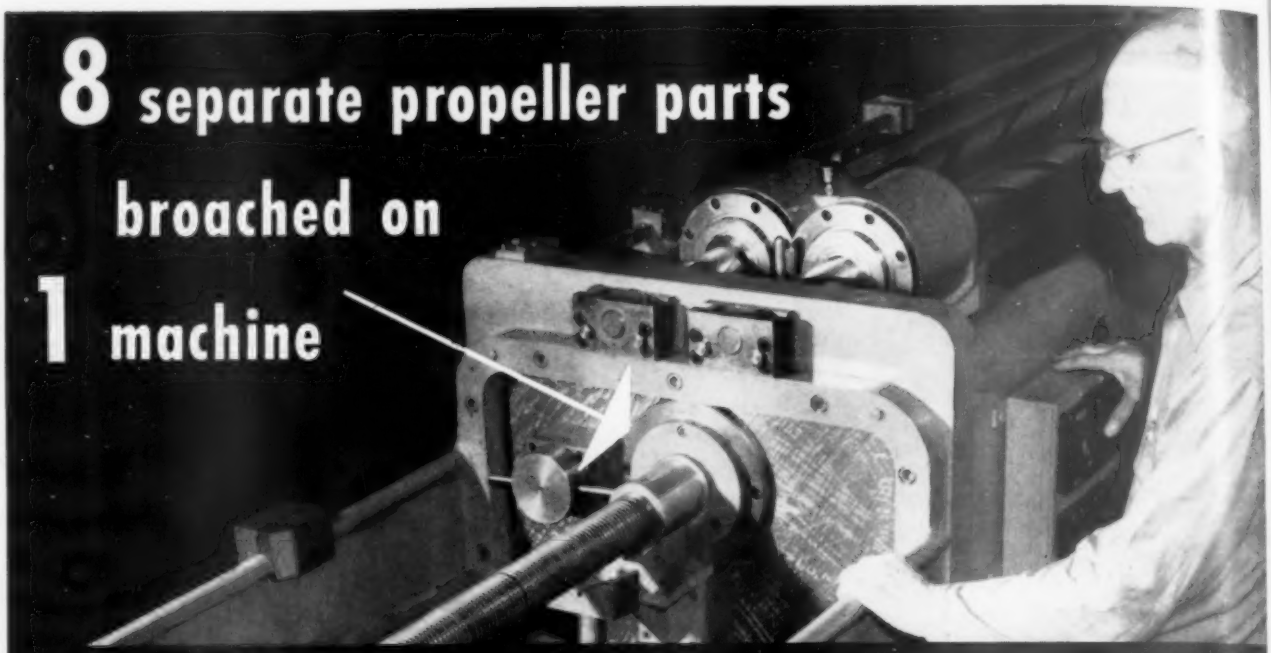
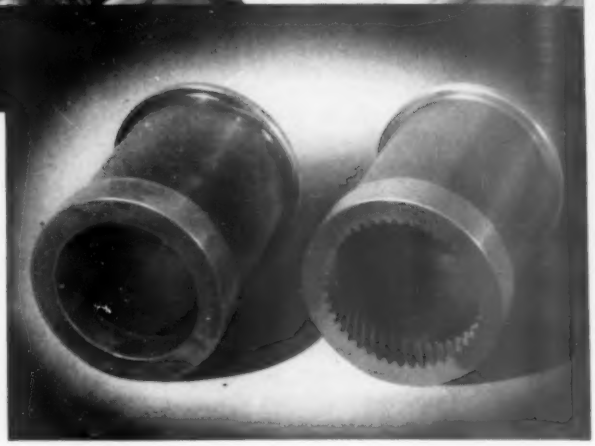
8 separate propeller parts broached on 1 machine



A PROPELLER MANUFACTURER GOT THESE BENEFITS FROM HIS AMERICAN HORIZONTAL MACHINE:

1. **Tooling is readily inter-changeable for eight separate parts of short run production.**
2. **Large parts are easily loaded and unloaded.**
3. **Double helical drive for right and left hand helix readily adaptable to machine.**
4. **The horizontal machine provided the most tonnage and stroke per dollar invested.**

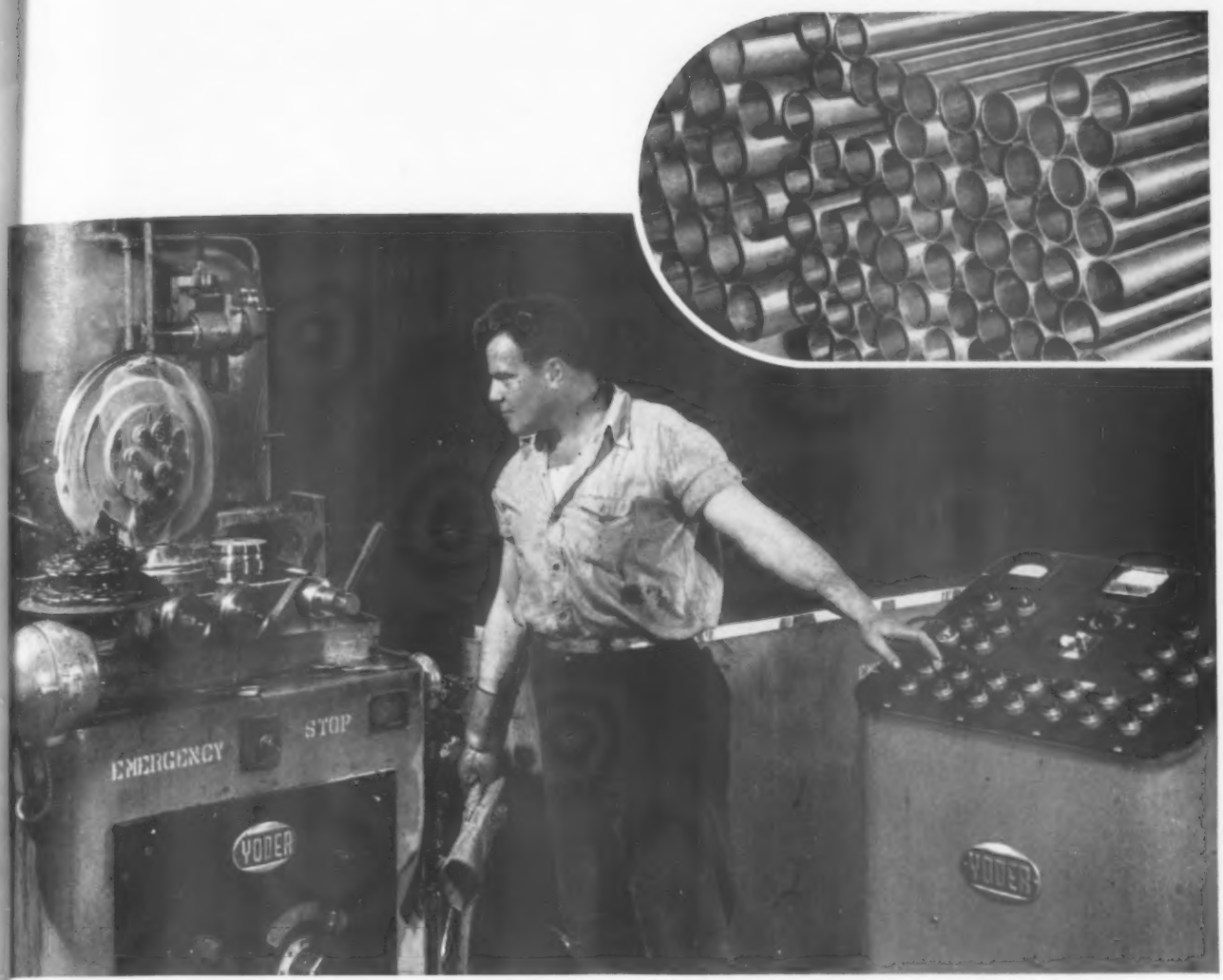


To broach the propeller sleeve gears, American built and equipped a standard HDE-30-72 horizontal broaching machine with six interchangeable lead bars for different internal spline operations. The machine broaches eight different propeller sleeve gears. Number of spline teeth vary from 43 to 55 with diameters ranging from 2¾″ to 3½″, and with length of splines cut ranging from ¾″ to 3″ long. Ask American which type of machine best suits your requirements. Just send a part print and hourly requirements for our recommendations.

AMERICAN *American* BROACH & MACHINE CO.
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.
ANN ARBOR, MICHIGAN

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery



Thinking of making PIPE OR TUBING?

In 1938, total U.S.A. production of electric-weld pipe and tubing was only 269,000 tons. But in that year, Yoder brought out a line of cold-roll-forming tube mills, equipped with their revolutionary new electric-resistance welder.

According to the latest available figures, U.S.A. production of electric welded pipe and tubing in 1950 was nearly 3,500,000 tons, a growth of 1300% in 12 short years.

Much of this growth was due to the advantages of the cold-forming, electric-weld process in general, and to the excellence of Yoder Tube mills in particular, because most such mills installed since 1938 have been built by Yoder.

With the new multiple cross-type welding transformer and other recent Yoder developments, Yoder mills now offer higher speeds and greater production than ever. If you have been thinking of making pipe or tubing, get the latest information on Yoder mills—yours for the asking.

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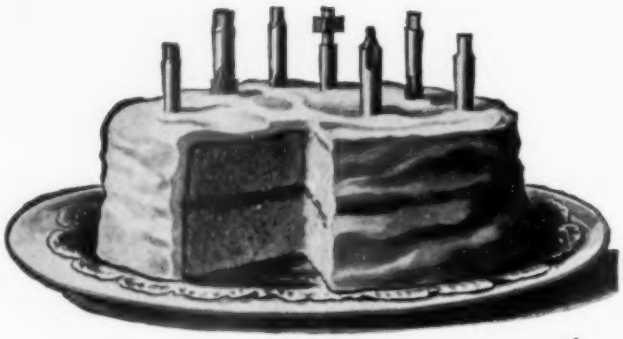
Complete Production Lines

- ★ COLD-ROLL-FORMING and auxiliary machinery
- ★ GANG SLITTING LINES for Coils and Sheets
- ★ PIPE and TUBE MILLS—cold forming and welding

ENGINEERING YODER MANUFACTURING



You CAN Have Your Cake — and Eat It!

You can profit by the economy of straight shank small tools (as compared with taper shanks) yet keep the convenience and speed of taper shanks by driving them with

Glenzer UTILITY DRIVERS

Each Glenzer Driver outlasts many small tools and provides a removable taper for each one.

Customers Report 40% to 75% Savings

Glenzer Utility Drivers (Sleeves) are made in all standard tapers and for all small tool sizes—either decimal, fractional, numbered or lettered.

Drive your drills, reamers, taps, end mills, key slot cutters and similar small tools the Glenzer Way for maximum efficiency and economy. *Utility Tools*

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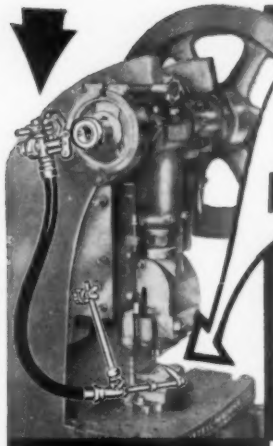

keep HANDS and FINGERS away from PRESS RAM

LITTELL Air Blast Valves

Eject Automatically by Air . . . not by Hand

SAVE TIME	. . Faster production and lower labor costs
SAVE AIR	. . Reduce air consumption 92 percent
SAVE DIES	. . No damage to dies due to clogging
SAVE HANDS	. . Keep operators' hands and fingers out of danger zone
SAVE MONEY	. . Insurance premiums are lower when accidents are reduced.

QUICKLY INSTALLED—Littell Air Blast Valves can be installed on any make or size press in only a few minutes.

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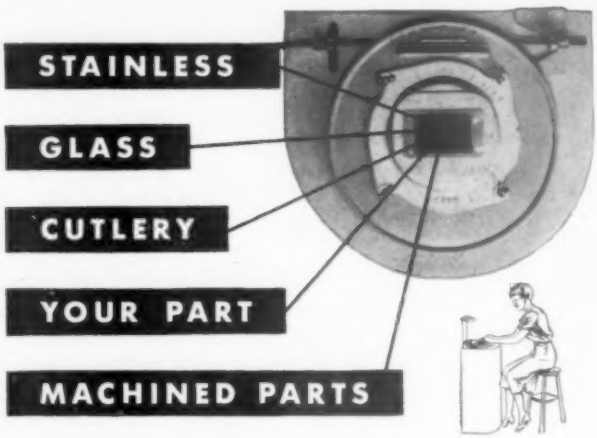

With Matthews "AIRGRIT", you'll be able to mark, in a fraction of a second, delicate or precision finished parts with hard, polished surfaces . . . parts which must not be marred or distorted by conventional marking tools. "AIRGRIT" actually breathes its mark . . . delicate but permanent. Write today for literature, and a sample of "AIRGRIT" marking.

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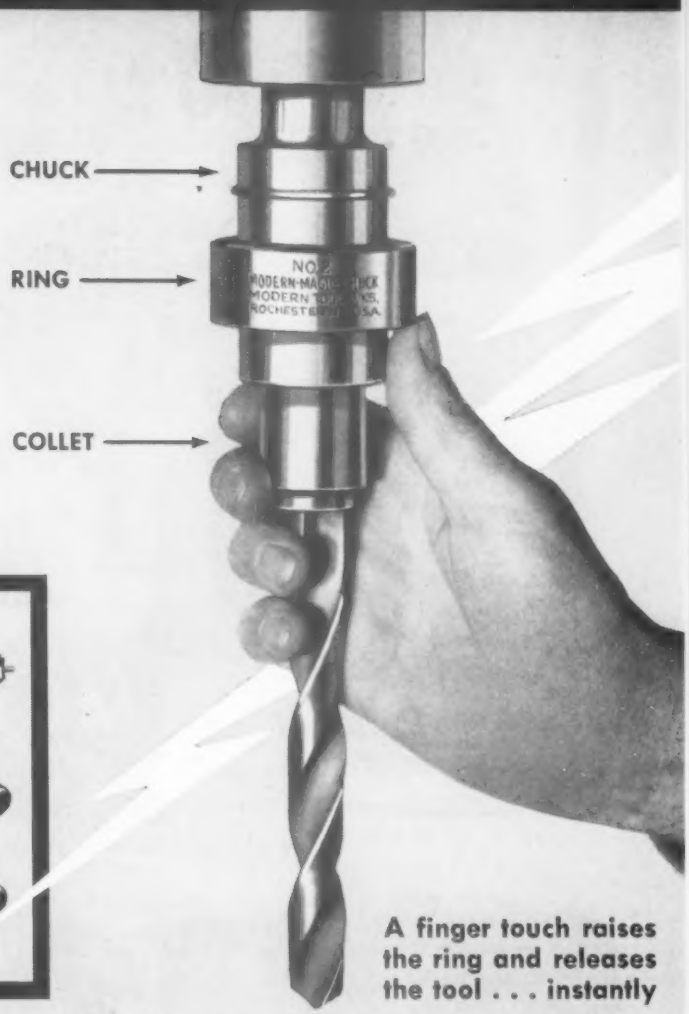
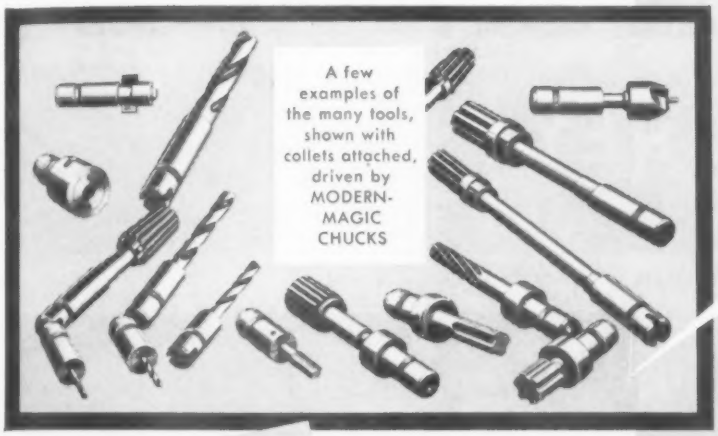
Speed up your production

Change tools without stopping . . . or even slowing the machine

MODERN-MAGIC QUICK CHANGE CHUCK and COLLET EQUIPMENT





A few examples of the many tools, shown with collets attached, driven by MODERN-MAGIC CHUCKS

Modern Precision Tools Include . . . . .

- STATIONARY SELF-OPENING DIE HEADS
- ROTARY SELF-OPENING DIE HEADS
- STATIONARY COLLAPSIBLE TAPS
- ROTARY COLLAPSIBLE TAPS
- MODERN-MAGIC CHUCKS AND COLLETS
- SELF-OPENING STUD SETTERS
- INSERTED BLADE FACE MILLING CUTTERS
- SOLID ADJUSTABLE DIE HEADS
- ADJUSTABLE HOLLOW MILLING TOOLS
- UNIVERSAL CHASER GRINDING FIXTURES

Modern-Magic Quick Change Chuck and Collet Equipment virtually eliminates costly lost time of revolving spindle machines. Used with such machines, tools are changed without stopping or even slowing the spindle. Changes are made from drill to reamer to tap instantaneously and safely while the machine is running at cutting speed. In this way, the Modern-Magic Chuck and Collet Equipment gives multiple spindle range to single spindle machines, increasing production and cutting cost. In high production shops, it has been proved they save time even though used only for changing from dull to sharp tools.

For full information, send for Bulletin M-103. In addition to standard Modern-Magic Chucks and Collets, it shows special types of each.

Only the ORIGINAL Modern-Magic Chuck and Collet Equipment carry the name "MODERN-MAGIC" and are manufactured by Modern Tool Works, Rochester, N.Y.

MODERN TOOL WORKS

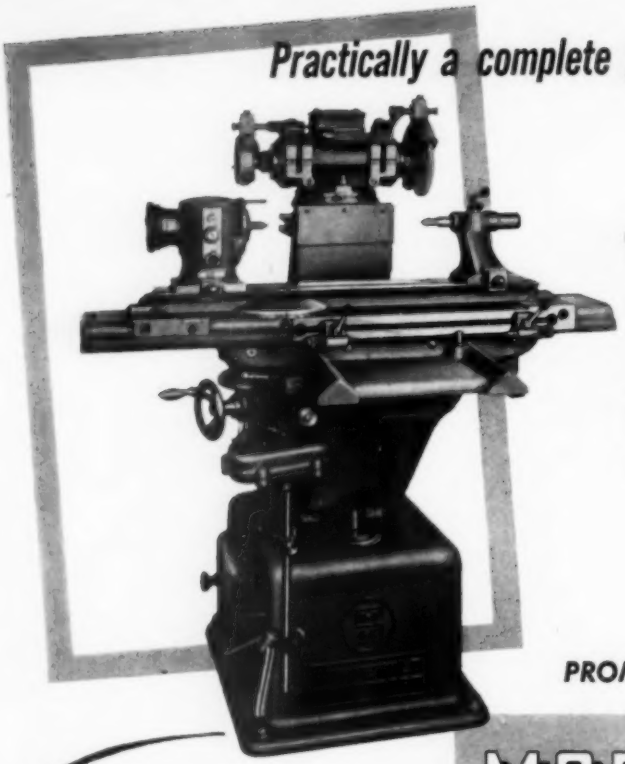
DIVISION

CONSOLIDATED MACHINE TOOL CORPORATION

SUBSIDIARY OF FARREL-BIRMINGHAM COMPANY, INCORPORATED

ROCHESTER, NEW YORK

Practically a complete grinding department in itself!



HAHN and KOLB WSRO UNIVERSAL TOOL and CUTTER GRINDER

Here's the most useful machine your grinding department can have . . . It does all the required work—and does it with precision, accuracy, speed and safety! With extra equipment it can be used as a tool grinder, a cutter grinder, cylindrical, internal and surface grinder . . . as well as for grinding twist drills, radial grinding and relief work at any angle setting within 360°.

Built in Germany to American specifications and measurements, the WSRO is sturdily constructed to give complete satisfaction wherever it is used. **Tooling interchangeable with American machine tools.**

PARTIAL LIST OF SPECIFICATIONS

Long. movement of the table	16"
Cross movement of the table	10"
Cylindrical grinding length	8-4/5"
Maximum swing over table	10"
Maximum grinding wheel	7"
Spindle speeds	3000 to 6000 RPM
Motor	1 HP

PROMPT DELIVERY • NO PRIORITIES REQUIRED
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Over 85% of the torque wrenches used in industry are

STURTEVANT TORQUE WRENCHES

Read by Sight, Sound or Feel

- Permanently Accurate
- Practically Indestructible
- Faster—Easier to use
- Automatic Release
- All Capacities

in inch ounces ...inch pounds ...foot pounds (All sizes from 0-6000 ft. lbs.)

Every manufacturer, design and production man should have this valuable data. Sent upon request.

P. A. STURTEVANT CO.
ADDISON QUALITY ILLINOIS

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There's a Walker Magnetic Chuck for Every Known Application . . .

Reliability—Strength

The Walker "Concentric Gap" Magnetic Chuck meets day-in, day-out requirements for a powerful chuck. For more than forty years, with a basic electro-magnetic circuit, the Walker "Concentric Gap" Chuck has proven itself reliable, efficient and economical.

•

Standard Electro and Permanent Magnetic Chucks . . . Vacuum Chucks . . . Special Applications for various holding problems . . . Demagnetizers . . . Magnetic Clutches.

Original Designers and Builders of Magnetic Chucks

O. S. WALKER CO. Inc.
WORCESTER 6, MASSACHUSETTS

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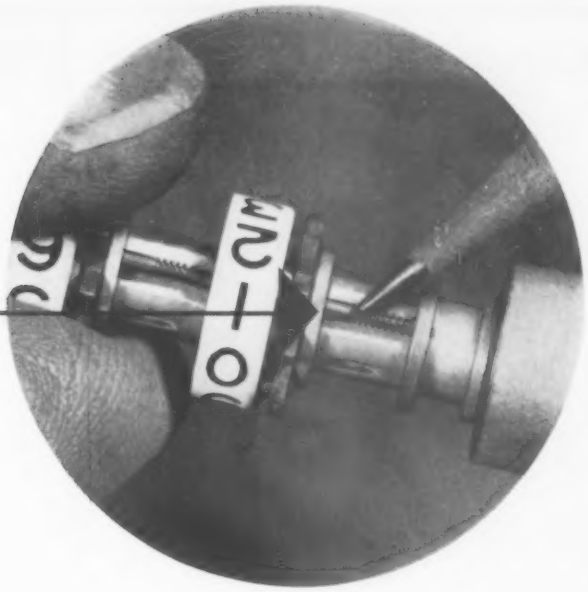
Eyestrain here *used to be* a big cost factor for **MONROE**



These little plunger pins locate the dials on the Monroe LA Desk Calculator. Each has a 90° cone point that fits into a detent of 110° included angle.

Previously, binocular microscopes were used to check cone angle, length, roundness, and diameter of these pins. But, the inspectors had to spend considerable time just resting their eyes—and running up the cost of the reliability that Monroe customers expect.

Now the microscopes are gone and checking these pins on the Kodak Contour Projector, Model 3, is more like watching television. Moreover, with the unique Surface Illuminator of the Kodak Contour Projector, inspectors are able to check surface finish on the cone tip of the plunger at 50×, to make sure of free movement and positive stopping of the calculator dials.

Many other parts involved in the foolproof operation of Monroe calculating machines are being inspected in large volume on a battery of Kodak Contour Projectors, Model 3. They average about 13 critical dimensions for each part, shapes are mostly rather complex. By carefully engineered mechanical gages, Monroe had brought the inspection time per piece down to an average of about 50 seconds. Optical gaging on the Kodak Contour Projector has brought this average down to 12 seconds.

If you'd like to find out if such economies could be effected in your production program, write and ask us for more information. Eastman Kodak Company, Industrial Optical Sales Division, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

A new sound movie shows how to simplify complex inspection problems. We'll tell you how to get it for a showing.

Kodak

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DEPENDABLE ACCURACY

INSPECTION TOOLS made of MEEHANITE METAL are designed to fill your various Inspection and Checking needs. Sturdily constructed to give you reliable, accurate service.

Surface Plates
Box Parallels
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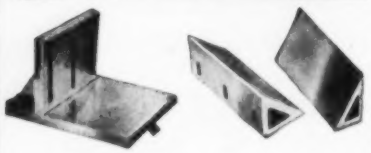

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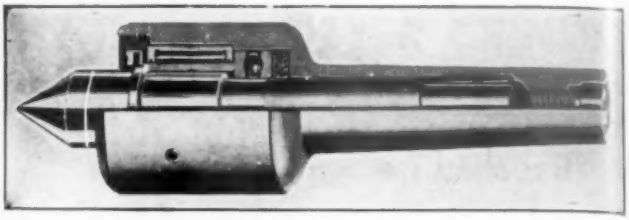
Maximum Production Minimum Care . . .



MOTOR TOOL LIVE CENTERS (Ball and Roller Bearing) are the only centers with the RED BAND OVERLOAD INDICATOR, which prevents overloading of thrust bearings. Designed for trouble-free service, MOTOR TOOL LIVE CENTERS require the least care for the most output.

Write for Bulletin

Eastern Representative

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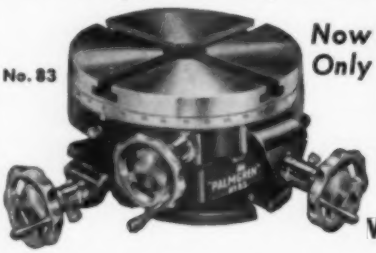
DUAL CROSS and ROTARY FEED

PALMGREN

Rotary, Index, Milling Table



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Turns Your DRILL PRESS Into A VERTICAL MILLER

Think what this will mean in your shop! Can be used on any Drill Press, Lathe or Milling Machine and provides what is practically a universal milling machine.

Designed for use in all types of metal and woodworking shops. A precision table permitting fine work to close tolerances. It is accurate, speedy, well constructed and attaches quickly in a firm position.

Rotary feed calibrated in degrees; Cross feed in thousandths; Dual Cross Slide with cross feed 2 ½" each side of center or 4 ¼" overall. Has acme thread cross feed screws, adjustable gibs on cross slides. 40 to 1 worm and gear ratio in rotary feed. Equipped with bolt slots and locking screws.

No. 83 Table Dia. 8", T-Slots ⅜", Base Keyway ⅜", Base Dia. 6¼", Ht. 5", Wt. 37 lbs. Price Only $54.50. Other Types available. No. 82 Dual Cross Feed only $43.75; No. 86 Rotary Feed Only $46.75.

Order Today! If dealer can't supply, write us. Ask for Circular No. 10

CHICAGO TOOL and ENGINEERING CO.

Mfrs. of PALMGREN PRODUCTS Since 1918

8391 South Chicago Ave. • Chicago 17, Ill.

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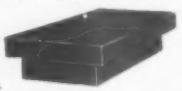
COLLINS

MICROFLAT

BLACK GRANITE SURFACE PLATES

Present an absolute continuous bearing surface, finished up to 50 millionths inch. Incredibly smooth. Falling objects do not cause humps. Being harder than hardened steel, can take greatest mistreatment without causing inaccuracy of surface. No oiling. Will not rust or warp. No re-scraping or frequent refinishing. Can use for spotting and "blueing in."

Immediate delivery in most sizes from 9x12 to 48x144. **Request Bulletin** and name of Distributor nearest you.



COLLINS MICROFLAT CO.

2326 E. 8th Street Los Angeles 21, Calif.

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FOR OVER 50 YEARS
MOLINE "Hole-Hog"
SPECIALLY DESIGNED
MACHINE TOOLS
HAVE CUT PRODUCTION COSTS
FOR AMERICAN INDUSTRY

MOLINE TOOL CO. MOLINE, ILLINOIS

DRILLING
BORING
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TAPPING and
Special Machines

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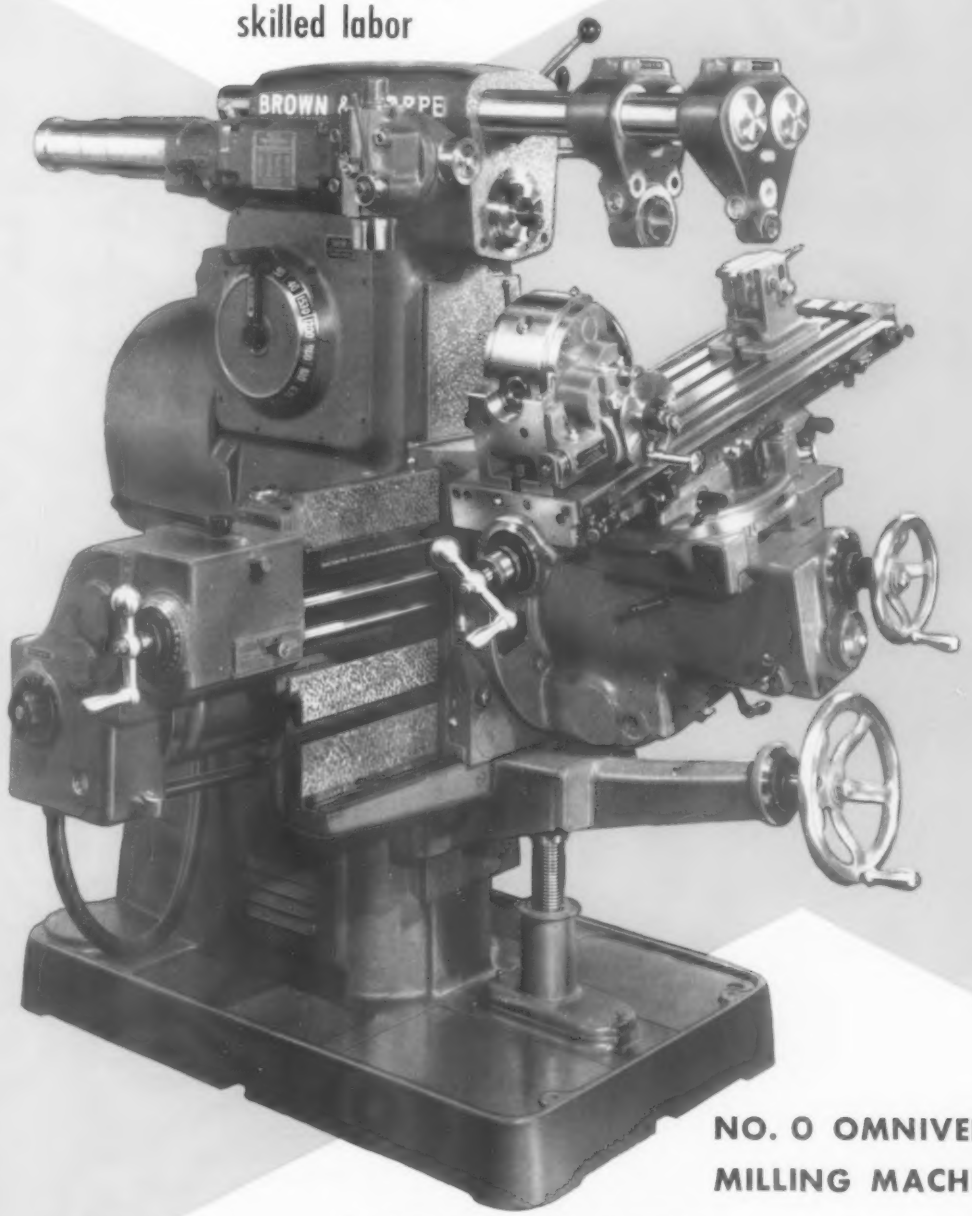
Productioneered

for extreme versatility, high precision, and conservation of skilled labor



NO. 0 OMNIVERSAL MILLING MACHINE

The flexible controls of this machine equip you to meet the widest variety of change-overs quickly and easily. It's "Productioneered" to keep your work-flow in toolrooms, experimental and research laboratories at a continuously high level. Work may be milled in a number of planes, or drilled, bored, or reamed at many different angles without relocating work in holding devices. Write for full details.

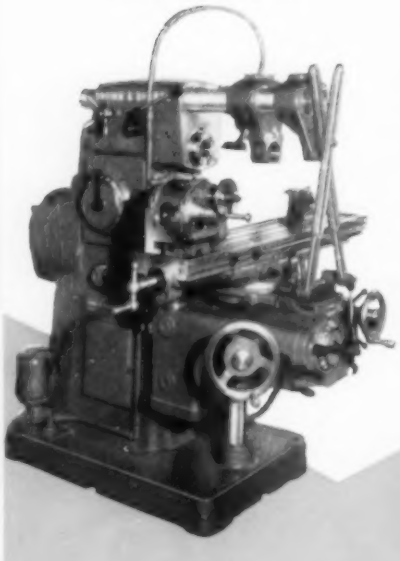
See next page for other Brown & Sharpe "Productioneered" Milling Machines.

Brown & Sharpe

B·S

Productioneered

for ready adaptability to unusual or ordinary jobs



No. 2 UNIVERSAL MILLING MACHINE 5 H.P.

The extra versatility of this Brown & Sharpe Universal equips you to meet sudden demands for change-overs quickly and easily — makes shorter runs more profitable — permits continuous high level production in spite of sudden product changes. Product-boosting features include: tri-motor drive, quick speed and feed selection, time-saving controls and extended spindle face. (Same features available in 3 H.P. machine.)

B·S

Productioneered

for versatile vertical milling

No. 2 VERTICAL MILLING MACHINE 5 H.P.

This vertical incorporates the time-saving features of the 5 H.P. Universal and Plain Machines, as well as the versatile swiveling spindle head which permits milling surfaces or drilling holes at different angular positions without use of special fixtures. (Same features available in 3 H.P. machine.)

B·S

Productioneered

for high-level output on long or short runs

No. 2 PLAIN MILLING MACHINE 5 H.P.

Designed for rapid, easy set-up and handling . . . built with more-than-adequate rigidity that maintains the original accuracy through long economical life. Efficient tri-motor drive, exclusive extended spindle face, time-saving controls. (Same features available in 3 H.P. machine.)

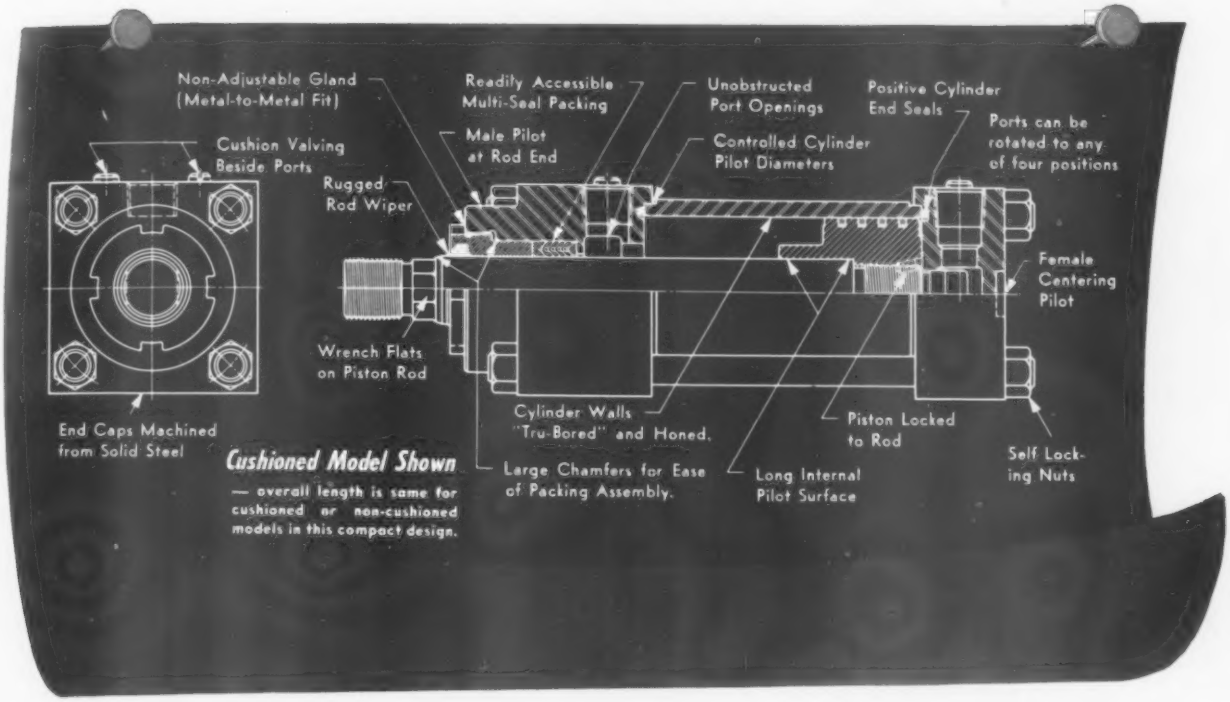
Write for specifications of these machines or information on any other Brown & Sharpe product. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

Brown & Sharpe B·S

Milling Machines • Grinding Machines • Cutters
Screw Machines • Machine Tool Accessories • Pumps
Machinists' Tools • Electronic Measuring Equipment
Johansson Gage Blocks • Permanent Magnet Chucks

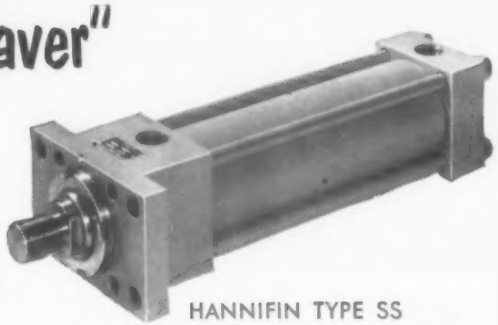
Machine Designers!

LOOK AT THIS DESIGN...


Non-Adjustable Gland (Metal-to-Metal Fit)
Readily Accessible Multi-Seal Packing
Unobstructed Port Openings
Positive Cylinder End Seals
Ports can be rotated to any of four positions
Cushion Valving Beside Ports
Male Pilot at Rod End
Controlled Cylinder Pilot Diameters
Rugged Rod Wiper
Female Centering Pilot
Wrench Flats on Piston Rod
End Caps Machined from Solid Steel
Cylinder Walls "Tru-Bored" and Honed.
Piston Locked to Rod
Self Locking Nuts
Large Chamfers for Ease of Packing Assembly.
Long Internal Pilot Surface
Cushioned Model Shown
— overall length is same for cushioned or non-cushioned models in this compact design.

HANNIFIN'S NEW "Space Saver" HYDRAULIC CYLINDERS

WERE DEVELOPED WITH YOU IN MIND!



HANNIFIN TYPE SS "SPACE SAVERS" ARE MADE IN NINE BORE SIZES—1½" TO 6" PRESSURES TO 2,000 P.S.I. IN FULL COMPLIANCE WITH J.I.C. HYDRAULIC STANDARDS.

You know that for a machine tool to perform properly, the hydraulic cylinders mounted in it have to be *right*.

So does Hannifin.

That's why we ask you to look at the superior design and construction features of the new Hannifin Type SS "Space Savers." We think you'll quickly recognize that here are hydraulic cylinders that make no compromise with good design . . . hydraulic cylinders you can count on for long, trouble-free service in the machines that bear your name. Complete specifications on these precision engineered cylinders belong in your files.

WRITE FOR BULLETIN 111
Complete description and specifications

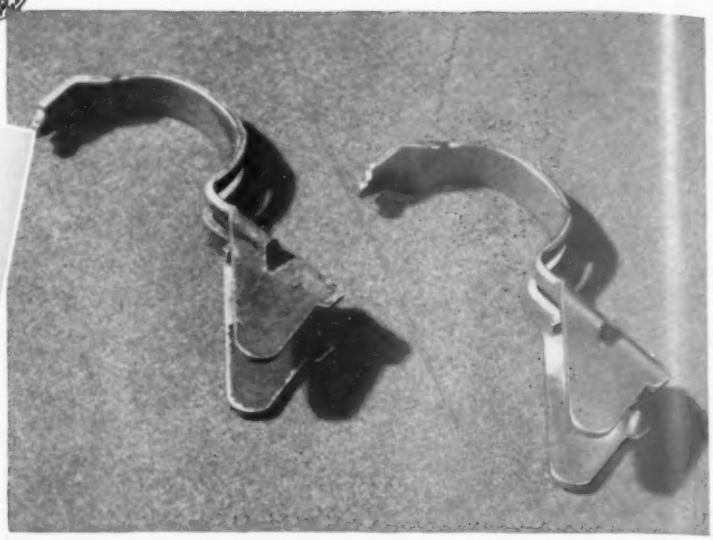
do ALL you CAN do...with

HANNIFIN

Hannifin Corporation, 1119 S. Kilbourn Ave., Chicago 24, Ill.

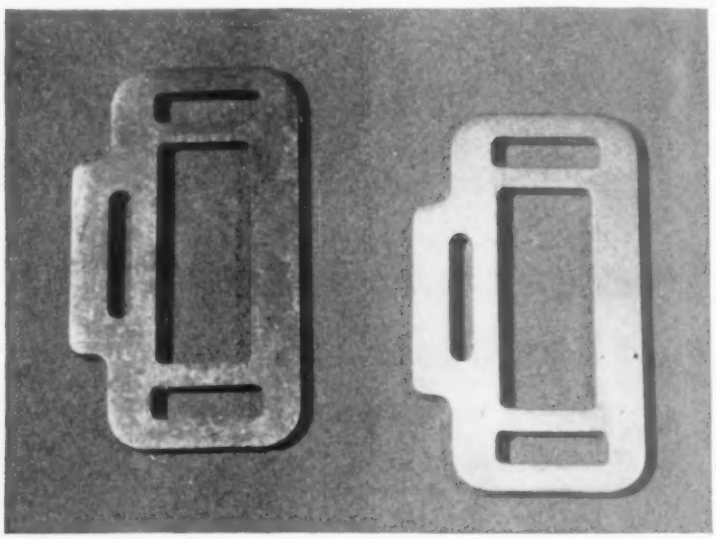
Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-153



REMOVING HEAT-TREAT SCALE and deburring the hard-to-get-at areas on these steel trigger guards with ALUNDUM Tumbling Abrasive helped speed up the finishing of these defense items.

You can BARREL-FINISH to BLUEPRINT ACCURACY with Norton ALUNDUM* Tumbling Abrasive



DEBURRING these parachute buckles — particularly the inner surfaces — is a good example of how barrel-finishing with ALUNDUM Tumbling Abrasive can solve a tough finishing job.

You get real *precision finishing* with Norton ALUNDUM Tumbling Abrasive. Being all aluminum oxide — not a bonded material — its cutting action is continuous, without glazing. It has the hardness required for fast, positive cutting and the hardness and toughness for long, productive service life.

Typical Jobs Where ALUNDUM Tumbling Abrasive Finishes Better, Faster, At Lower Cost

Deburring stampings, castings, etc. . . . breaking sharp edges uniformly . . . producing radii to blueprint specs . . . improving micro-inch-readings . . . finishing threaded and high precision parts . . . removing paint, plating or heat-treat scale.

See Your Norton Distributor

For every barrel-finishing application, on ferrous or non-ferrous metals, for any type of barrel, there's a grit size of ALUNDUM Tumbling Abrasive that will give you exactly the results you want. Your Norton Distributor can supply you promptly — and he'll gladly call in a Norton Abrasive Engineer to study your finishing operations and make specific recommendations.

NORTON COMPANY
Worcester 6, Mass.
Distributors In All Principal Cities
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Get This Valuable Handbook

55 illustrated pages describing every detail of barrel-finishing. Ask your Norton Distributor or write us direct for your copy of Form 501.

NORTON
ABRASIVES
Making better products to make other products better

SURROUNDED BY PLUS VALUES

THE LEES-BRADNER "40" THREAD MILLER

It takes precision plus to thread shell cases accurately for the reception of delicate fuse mechanisms. Speed, easy loading and semi-automatic operation are other important considerations.

That's why the Lees-Bradner Model "40" Thread Miller was chosen to perform this highly important operation.

You, too, can get unusual accuracy at high speed and with a minimum of scrap on precision threading operations. Just contact your Lees-Bradner representative and ask him for all the details on this remarkable machine.

the LEES-BRADNER Company

CLEVELAND 11, OHIO, U.S.A.

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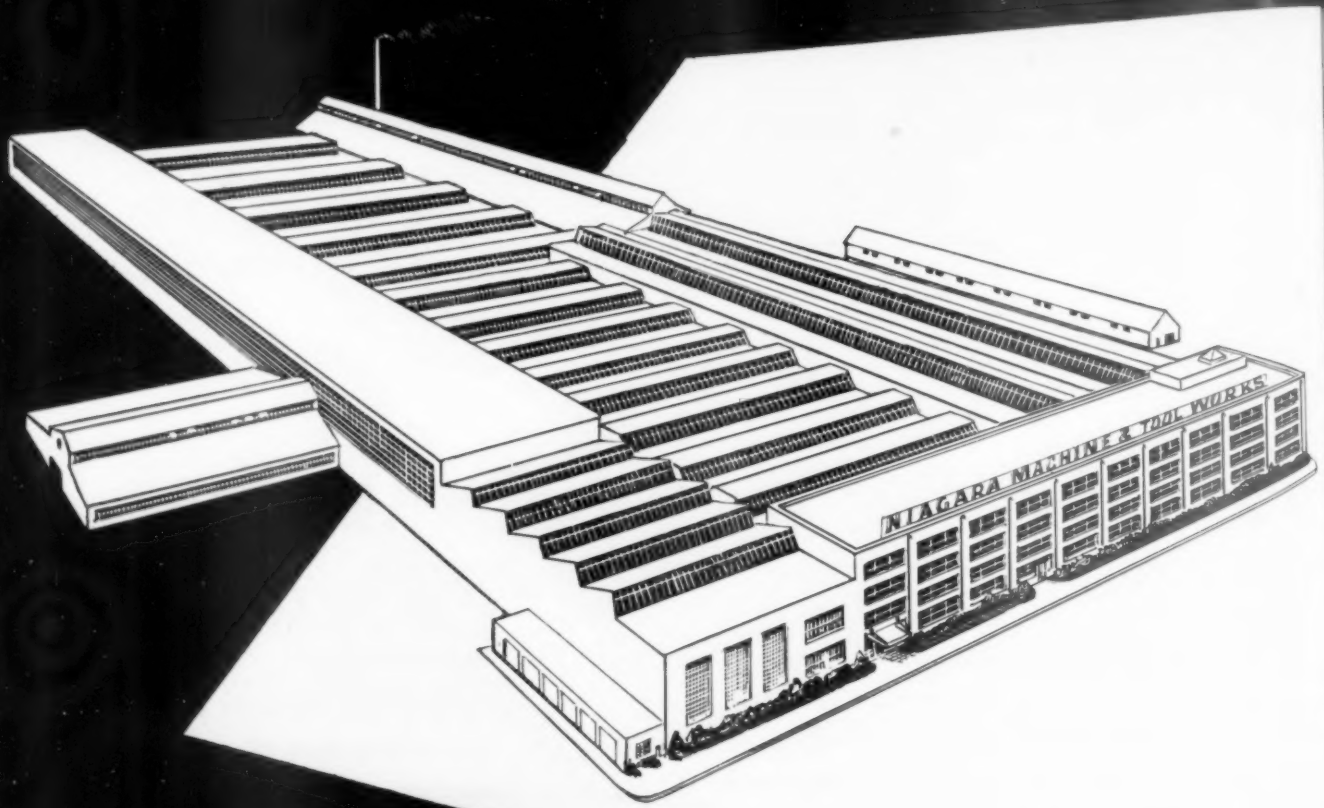
The home of America's Most Complete Line of Presses, Shears, Machines and Tools for Sheet Metal Work



This modern Niagara plant is the result of an unbroken record of 72 years of growth and accomplishment under one management . . . that of its founders and their successors trained in the business of designing and building machines superlatively well.

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Since 1879

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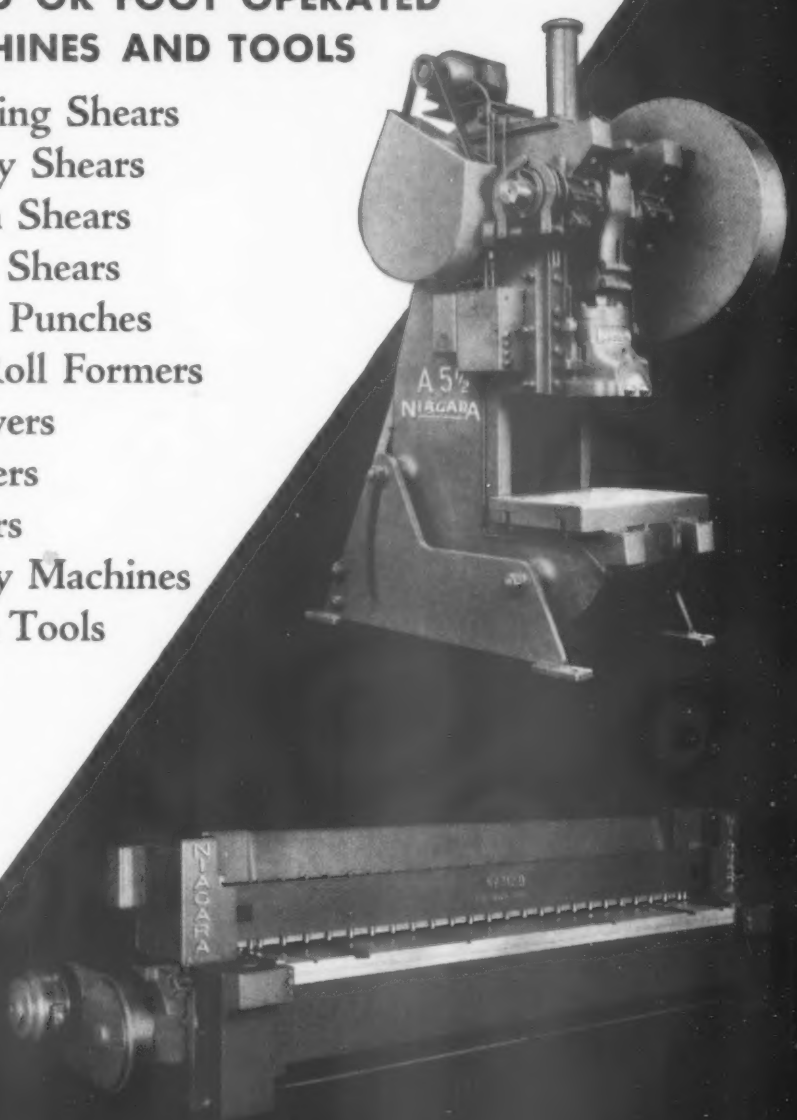
Folders
Rotary Machines
Drum Making Equipment
Electric Automatic Welders

HAND OR FOOT OPERATED MACHINES AND TOOLS

Squaring Shears
Rotary Shears
Bench Shears
Lever Shears
Lever Punches
Slip Roll Formers
Groovers
Seamers
Folders
Rotary Machines
Hand Tools



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Give us your power cylinder problems!

The engineers of Anker-Holth have a vast fund of cylinder "know-how". Their background of experience covers the application of cylinder power to machines and equipment of many types and sizes. They are continually working with design engineers to develop the most efficient answers to power motion problems . . . air and hydraulic.

These cylinder specialists . . . backed by the modern manufacturing facilities of Anker-Holth . . . are at your service to make sure you get the *right* power cylinder *for your specific problem.* For help, call today or write *Anker-Holth Div. of The Wellman Engineering Co., 2727 Conner St., Port Huron, Michigan.*

Anker-Holth manufactures hydraulic and air-operated cylinders in a wide range of sizes and types for push, pull, lift or lowering action. This air cylinder has a 24-inch bore and 36-inch stroke.

Anker-Holth
ENGINEERED CYLINDER POWER
WELLMAN
Division of THE WELLMAN ENGINEERING COMPANY

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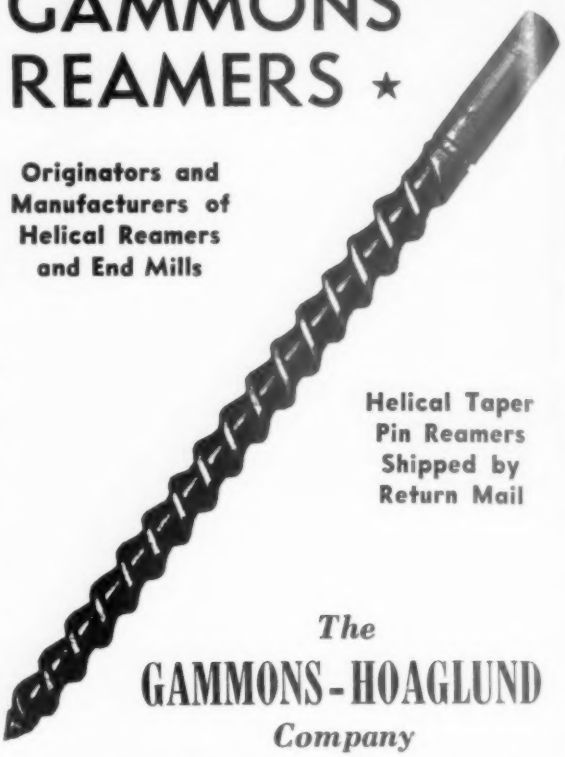
GAMMONS REAMERS ★

Originators and Manufacturers of Helical Reamers and End Mills



Helical Taper Pin Reamers Shipped by Return Mail

The
GAMMONS-HOAGLUND
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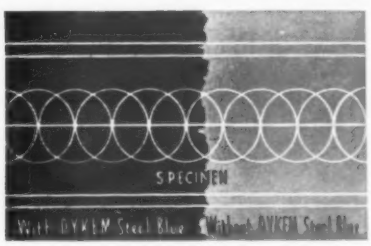
DYKEM STEEL BLUE

STOPS LOSSES

making dies & templates



Simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout show up in sharp relief and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information

THE DYKEM COMPANY, 2303D North 11th St., St. Louis 6, Mo.

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Cut Costs on Hole-Cutting with BOREMASTER

5" Holes in 1" steel plate in 80 seconds
Precision within .004"

Finished holes 1½" to 11¾" diameter to a depth 8" in one rapid operation on your present equipment with the BOREMASTER. Comparable boring tool finish.

Not just another trepanning cutter but a real heavy duty tool. Stock removed in one piece, eliminating waste.

Time Savings + Material Savings = Cost Savings

For details, write:

KARL A. NEISE, 381 4th Ave., Dept. A, New York 16, N. Y.

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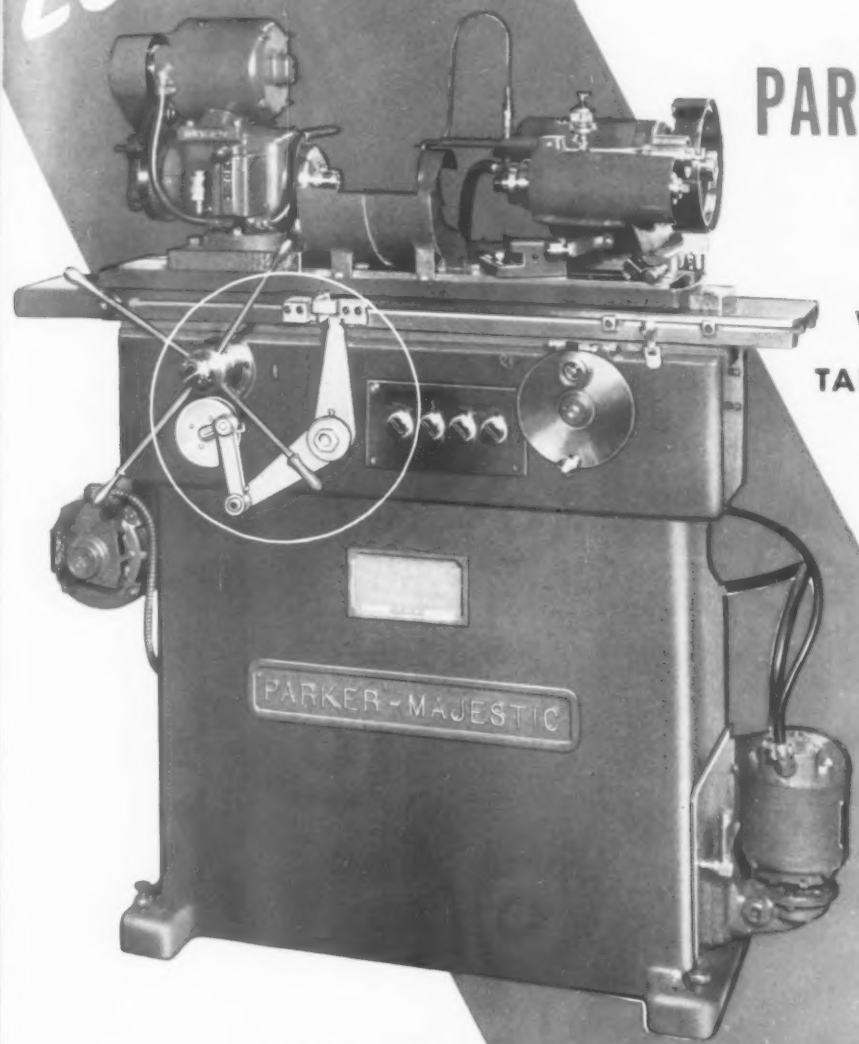
FOR ECONOMY

PRECISION MACHINES pm PARKER · MAJESTIC



PARKER-MAJESTIC GRINDERS

WITH THE ADJUSTABLE

TABLE RECIPROCATING MECHANISM*

Give Smoother Performance

AND GREATER ACCURACY

OUTSTANDING FEATURES

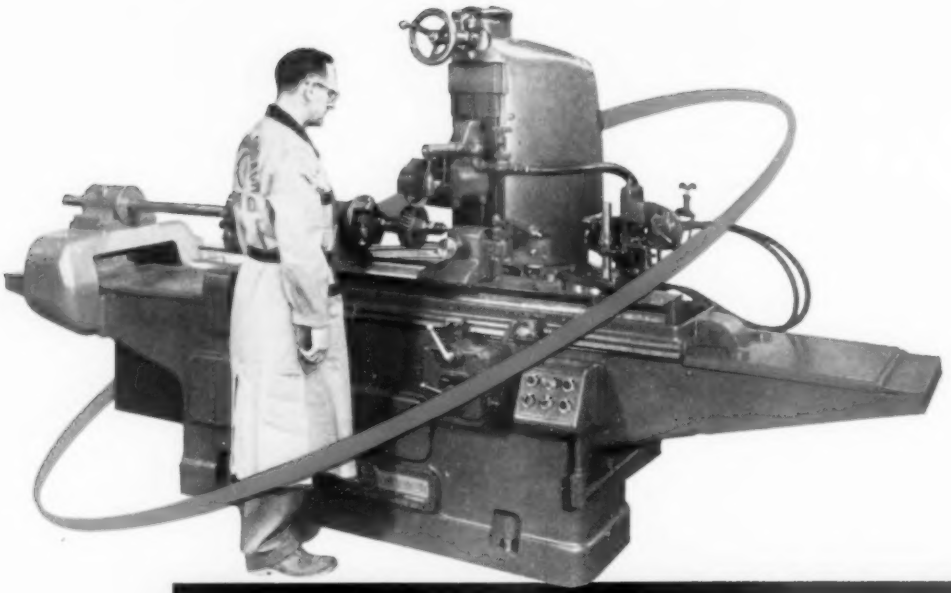
1. Positive Mechanical Operation.
2. Reciprocating Table travel adjustable from 0" to 3".
3. Rapid and accurate table movement.
4. Four table speeds—15, 30, 45 & 60 reversals per minute.

*Optional equipment with most models of Parker-Majestic Internal or External Grinders.

PARKER-MAJESTIC, INC.

formerly Majestic Tool & Mfg. Co.

147 JOS. CAMPAU • DETROIT 7, MICHIGAN



NEW HELICAL GEAR AND SPLINE GRINDER

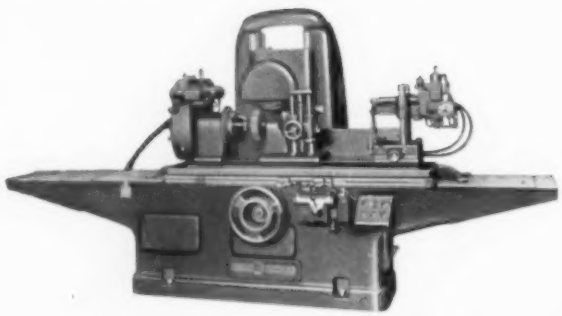
Assures Highest Accuracy in both Lead and Tooth Form

Indexing mechanism of the Helical Grinder

The new Red Ring Helical Gear and Spline Grinder, Models SGF-12" and 18", incorporate the lead bar principle thus eliminating the inherent errors, human and mechanical, of conventional methods heretofore used to maintain specific lead or helix angle.

The lead of every gear tooth or spline is exactly alike—exactly the same as that of the precision ground master lead bar which rigidly controls the progressive rotation of the work part as it is traversed under the grinding wheel.

The grinding wheel is dressed to any desired tooth form. That form is controlled by a hardened steel master form plate which guides the movement of the dresser diamonds.



Red Ring Spur Gear and Spline Grinder, Models SGD-12" and SGC-18"

Write for descriptive folder on Red Ring Gear and Spline Grinders both helical and spur.

NATIONAL BROACH & MACHINE CO.

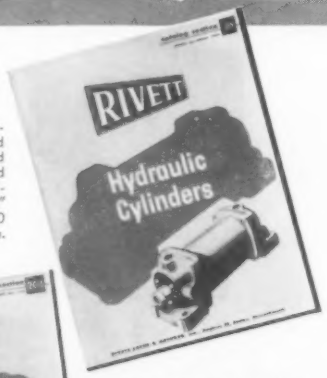
5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

The sweetest story ever told—

on AIR and HYDRAULIC POWER!

Rivett Hydraulic Cylinder Catalog Section 105—
Details: Cushioned and non-cushioned, standard rod and 2:1 over-size rod, single and double end rod, internal and external threads, all standard mountings in 2" to 10" bores. Offered for 1500 P.S.I. 3000 P.S.I. available.



Rivett Hydraulic Valve Catalog Section 203—
Details: 4-way, 3-way, pilot, and remote valves in 6 types of operation, 4 types of action, 7 sizes, 5 piston designs. Offered for 1500 P.S.I. 3000 P.S.I. in most models.

These five books, totaling 68 pages, are jam-packed with all the important and necessary data required to lay out successful air and hydraulic circuits. Over 400 Rivett models, in a variety of sizes, are detailed — every standard air and hydraulic component offered in the industry. Description of each model includes working drawings, specifications, and cutaway views. All data pertaining to each model is shown on one page to facilitate layout. Easy to use, complete in information, these Rivett catalogs are a must on every board. Write to Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass.

439 standard Rivett models described!

—All the necessary components for any efficient circuit.

Rivett Hydraulic Power Unit Catalog Section 400—
Details: Single, double and combination pump types. Single—.4 G.P.M. to 40 G.P.M. at 1000 P.S.I. Double—3.5 G.P.M. to 48 G.P.M. at 1000 P.S.I.

Rivett Air Cylinder Catalog Section 55—
Details: Cushioned and non-cushioned, single and double end rods, internal and external threads, 7 standard mountings in 1½" to 12" bores. Offered for 150 P.S.I. air and 300 P.S.I. oil services.

Rivett Air Valve Catalog Section 303—
Details: 4-way and 3-way, pilot and remote valves in 5 types of operation and in 5 sizes. Offered for 150 P.S.I. service.

Rivett Lathe & Grinder, Inc., Brighton TE 10, Boston, Mass. Please send me: ☐ Hydraulic Cylinder Catalog 105 ☐ Hydraulic Valve Catalog 203 ☐ Hydraulic Power Unit Catalog 400 ☐ Air Cylinder Catalog 55 ☐ Air Valve Catalog 303

Name _____ Company _____

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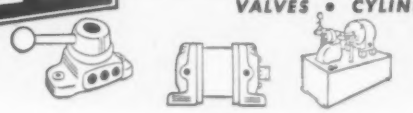
RIVETT furnishes a complete power package

VALVES • CYLINDERS • POWER UNITS

Air and Hydraulic
All sizes and types



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HIGH PRODUCTION TOOLING

GOOD WAY TO BREAK A PARTS BOTTLE NECK . . .

Just the type of machine smart production men are looking for *NOW*

because:

1. It's very ***compact.***
2. It's very ***easy*** to tool and operate.
3. It's very ***simple*** and dependable.
4. It's extremely ***accurate.***
5. It's unusually ***versatile.***
6. It regularly turns in ***outstanding*** production records.

BAIRD NO. 54VC 4 SPINDLE VERTICAL LATHE

The versatility of the Baird No. 54VC (automatic vertical continuous lathe) makes it a most valuable machine for wet or dry cutting of light jobs such as boring piston ends, facing, chamfering, turning bands, etc. It has 4 spindles with 5" chucks mounted in the turret which revolves continuously, eliminating non-productive indexing time. The grip of holding fixtures automatically releases for operator to load and unload. Tools feed in and out of the cutting stroke.

Tools move horizontally for facing operations while other tools operate vertically for turning. Worm and gears drive the turret . . . spindles, mounted in roller bearing are driven by helical gears. Fool-proof controls prevent feed of tools to work unless spindles are revolving. Splash guard (as pictured) is used for wet operation. Speed changes are simple, inexpensive.

Baird engineers will provide tooling recommendations and case histories of accurate, fast, profitable production. Bulletin and specifications on request.

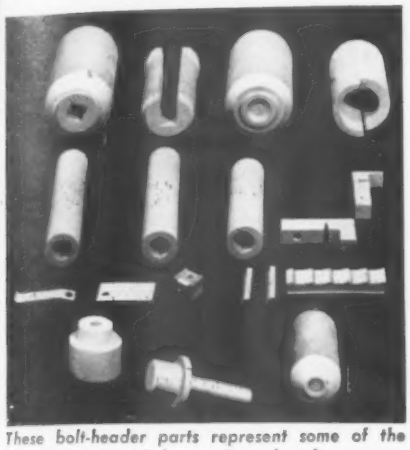
the BAIRD MACHINE COMPANY
STRATFORD • CONNECTICUT

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributors: Bethlehem Steel Export Corporation



These bolt-header parts represent some of the many uses at our Lebanon, Pa., plant for our carbon tool steel of cold-heading quality. As a large user of our own tool steels, we gain valuable experience to help solve our customers' problems.

How Our Proving Ground Helps Tool Steel Users

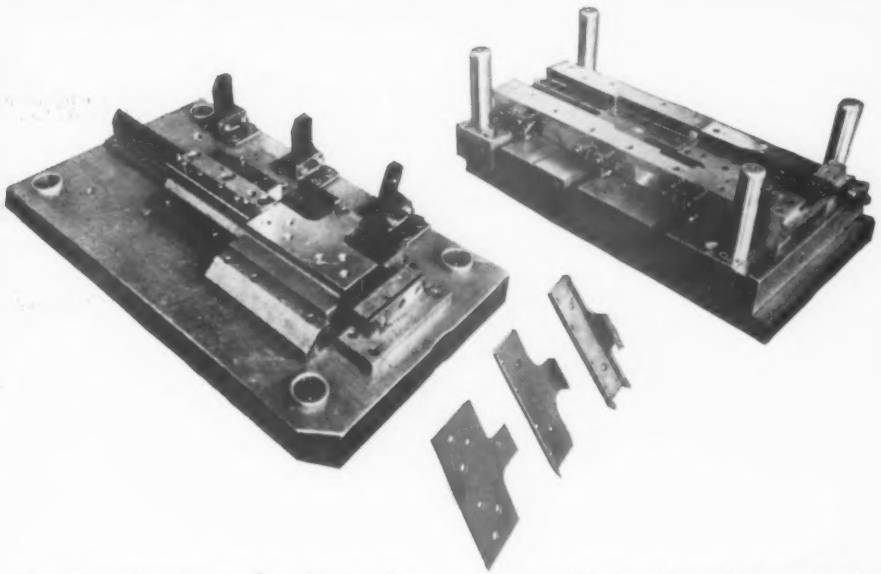
Many people think of a particular tool steel in terms of its chemical analysis. Others may classify it according to its properties. But when all's said and done, from the standpoint of the user a particular tool steel is one that does or doesn't do the job on a specific application.

We ourselves are one of our own largest tool steel customers. We use tons of Bethlehem tool steel every year. Our steel and manufacturing plants, our fabricating works and shipyards, make a vast proving ground, giving us very special opportunities to check up on our tool steel, watching it at work on nearly every kind of job imaginable.

That helps us — and our customers — in two ways. First, it yields the kind of first-hand practical experience in the treatment and application of the various grades of Bethlehem tool steel that can only be gained by living with them every day. Second, it provides a huge store of valuable information on tool design, heat-treatment, and tool and die performance.

All this helps not us alone but, as we say, helps us to help our customers to get the most out of tool steel. So if you have a problem in any way related to tool steel selection or treatment, we invite you to tell us about it. The chances are several to one that our experience can be helpful. It is yours for the asking.

Heavy-duty Die Packs 300-ton Wallop



This three-stage progressive die punches, shears, trims, and forms parts from steel plate in a 300-ton press. It turns out about 2500 each shift. All wearing portions of the die are made of 67 Chisel, our chrome-tungsten grade of shock-resisting steel. Hardened to Rockwell C-53, it produces upwards of 30,000 pieces before redressing is needed. The guard-rail clip angles, shown in foreground, are made from high-carbon steel plate of approximately .218 in. gage.

Renowned for its extreme toughness, 67 Chisel has excellent wear-resistance for a wide range of heavy-duty jobs. It's often used for punches, swaging dies, chipping chisels and machine parts subject to repeated shock . . . heavy shear blades for cold work and also for hot-work jobs up to 1000 F. And it's a popular choice for master hobs.

Tools made from 67 Chisel are readily carburized. This makes possible a very hard surface, reinforced by a core that's really tough.

67 Chisel is an easy steel to machine and heat-treat. It's stocked in many sizes for quick shipment.

Its typical analysis:

C	*Si*	*Cr*	*W*	*V*
.50	.75	1.15	2.50	.20

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Keep those cutting tools sharp

In many shops the resharpening of production cutting tools is neglected too long. In an effort to keep output at a peak, such tools are sometimes kept in use beyond the point where the cutting edges become excessively dull.

Just what happens when edges are dull? For one thing, the dull edges begin to cause an increase in the load on the shearing or cutting edges. If the dullness is carried to extremes, tools will break. Dull cutting edges also produce rough surfaces on the parts; this may result in rejection due to defects or because the tolerances have been exceeded.

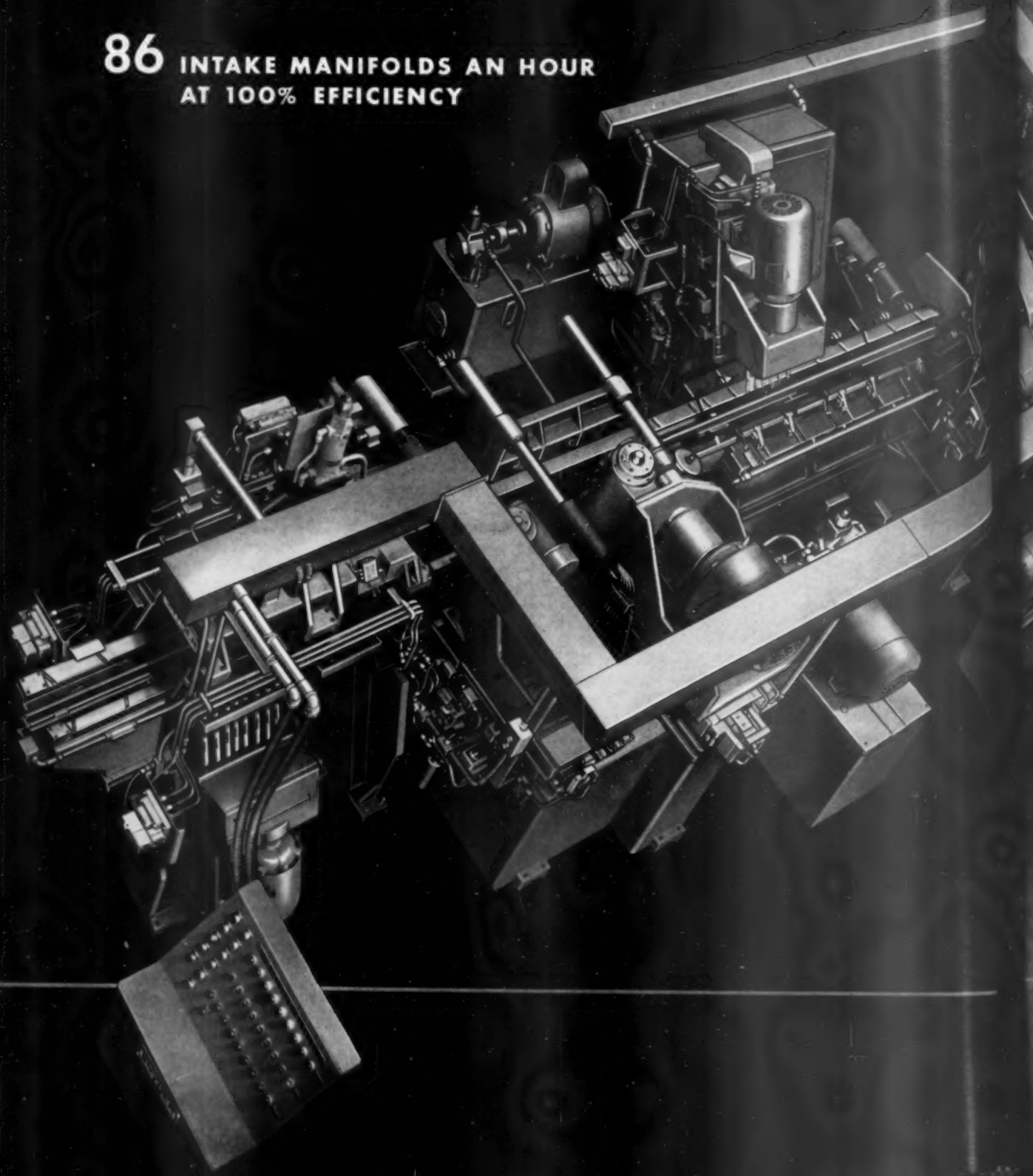
If resharpening is delayed too long, it may be impossible to recondition a tool properly. Deep spalls, cracks, and gouges cannot be removed. Usually there is an economic balance point on each type of operation where it is best to resharpen. This point must be determined for each operation. Regular inspection of tools will show any unusual conditions causing excessive dulling.

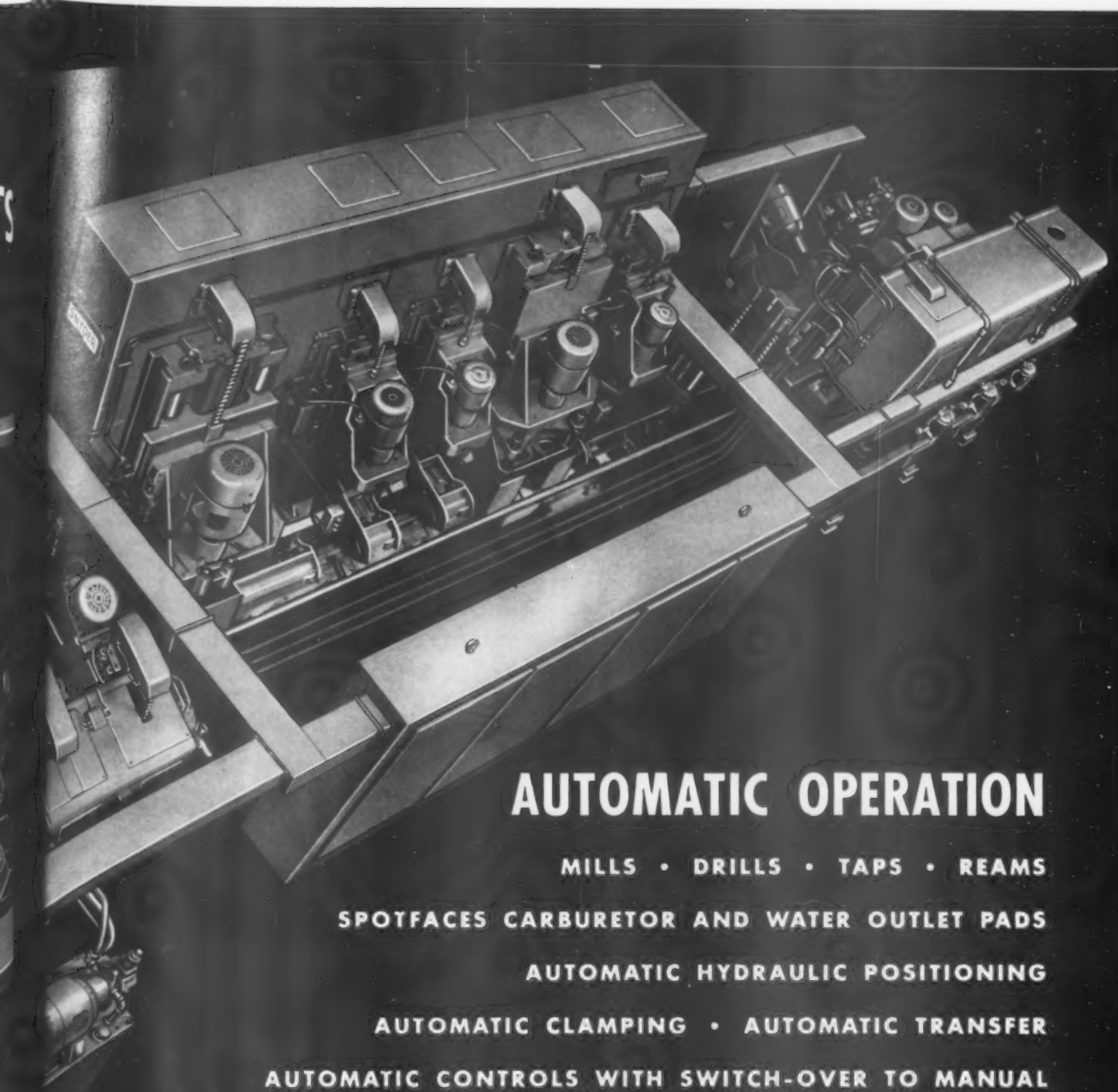
Preventive maintenance of cutting edges pays off in longer tool life and fewer broken tools.

SNYDER MACHINES CONTROL COSTS

22 STATION
AUTOMATIC TRANSFER

86 INTAKE MANIFOLDS AN HOUR
AT 100% EFFICIENCY





AUTOMATIC OPERATION

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SPOTFACES CARBURETOR AND WATER OUTLET PADS

AUTOMATIC HYDRAULIC POSITIONING

AUTOMATIC CLAMPING • AUTOMATIC TRANSFER

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SPEED UP Screw Machine Production

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- SPECIAL CUTTING TOOLS
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Inasmuch as we manufacture cams and tools for the trade we obviously do so on a production basis. As a result we offer:
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Let us quote on your tool requirements. You'll save money . . . even as compared with "home made" tools. Standard circular form tools for B&S and Davenport Machines carried in stock. Immediate delivery.

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Here's a "Hy-Power" machine that punches as many as 16 holes *at once* in the structural steel sections that make up the sturdy frame of the world-famous New Holland Machine Company hay baler.

This simple, versatile and inexpensive unit—designed by New Holland engineers—makes possible economical, precision, multiple-hole punching of even short runs. Individual cylinders are easily and quickly positioned to meet different job specifications . . . then connected to convenient openings in the pressure and return lines.

The sixteen 5000 p.s.i. "Hy-Power" Cylinders are powered by two exclusive Hannifin "Hy-Power" Hydraulic Pressure Generators . . . compact units including motor, pump, oil reservoir, control valves and high pressure intensifier. *This is "Hy-Power" Hydraulics!*

OUR BULLETIN 150 TELLS
the complete story of Hannifin "Hy-Power" Hydraulics. Your copy sent on request.

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Proved in many fields, "Hy-Power" Hydraulics can provide better, faster production and performance for one-of-a-kind specials like this or for the machines you may build repetitively. Why not investigate this equipment that permits applying forces up to 100 tons . . . in any direction . . . simultaneously? Why not learn all about the nearly 100% salvageability of "Hy-Power" components when set-ups must be changed? A Hannifin representative will explain how you can utilize "Hy-Power" for punching, riveting, staking, bending or crimping operations. Hannifin Corporation, 1119 S. Kilbourn Ave., Chicago 24, Ill.

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Accuracy Maintained!

Regardless of size with Simplex

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A heavy and hard to handle steel casting, with two blind holes which had to be held to close alignment tolerances, was easily machined on the SIMPLEX #4U 2-Way Precision Boring Machine pictured above. Three operating stages, rough bore, semi-finish bore and groove, and finish bore were used to complete the machining in the bores without removing the casting from the fixture. Machining operations were performed using the SIMPLEX #5 Precision Boring Heads equipped with removable boring and grooving heads.

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SIMPLEX MACHINE TOOL DIVISION

STOKERUNIT CORPORATION

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PRECISION BORING MACHINES • PLANER TYPE MILLING MACHINES • SPECIAL MACHINE TOOLS

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Hydroforming

CINCINNATI 26" HYDROFORM

Five Hydroform models, capable of forming blanks 12", 19", 23", 26" and 32" in diameter are available. Information on machines of larger capacity furnished on request.

Hydroform

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO

produces deep drawn parts in fewer operations!

One "hug" of the Cincinnati Hydroform produced the finished shape shown in the photo at left. The part, drawn to a depth of 8½" from a 25" dia. blank of .062" aluminum, formerly required five operations to produce.

Hydroforming makes possible the deep drawing of intricate shapes in far fewer operations than conventional practices allow. Many examples are on record where two, three—often more—operations have been saved. Most parts can be Hydroformed in a single draw. But where the shape of the part requires more than one operation, two or more blanks can be stacked and preformed in one stroke. The Hydroform can be tooled to trim, pierce and form light gauge metals in the same operation.

The savings of operations by Hydroforming is but *one* major advantage. The simple tooling required reduces tool costs up to 90%. Practically any shape, from a wide variety of materials up to ⅜" thickness, can be Hydroformed. Part quality is materially improved. Springback, thin-out and spot stresses are greatly reduced or eliminated. Surface finish of the material is unimpaired.

Investigate Hydroforming now. It will change your thinking on deep drawing and forming. Consult your nearest Cincinnati Milling Machine Co. representative for detailed information on this revolutionary metal forming process.

Air Cleaner Cover of .025" Steel. Hydroformed in 1 operation, including hole. Previous method required draw dies and 2 operations.
Jet Engine Detail of .032" Stainless Steel. Hydroformed in 2 operations. Previous method required 6 operations and 4 anneals.
Chocolate Mold of .035" Stainless Steel. Hydroformed in 1 operation. Formerly produced with draw dies in 3 operations, 2 anneals.
Cover of .062" Stainless Steel. Hydroformed in 1 operation. Conventional method required draw dies and 2 operations.

WRITE FOR NEW HYDROFORM BULLETIN

For a complete description of Hydroforming—tooling details, operation, examples of Hydroformed parts, machine dimensions, and general specifications —write for your free copy of Bulletin M-1759.

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Cut it Better-Faster-Cheaper with

CARMET

Carbide Tools

What other jobs have you for **CARMET** *to do*

We specialize in precision preforming of Carmet carbide metals to *any* shape for special wear-resistance needs, such as dies, gage blanks, etc. Let us quote on *your* requirements.

The Allegheny Ludlum line of Carmet Carbide Tools is *complete*—every style, size and grade you may need for any cutting job in the shop. If you make your own tools, a full line of blanks is available, too—as well as all necessary sizes of A-L Shank Steel. Extensive stocks of Carmet standard tools and blanks are carried in A-L and Distributor's warehouses coast to coast, and special tools are available to order. ● Just remember, for best performance on any application, *use Carmet!*

Allegheny Ludlum Steel Corporation

CARMET DIVISION, Detroit 20, Michigan

WAD 4134

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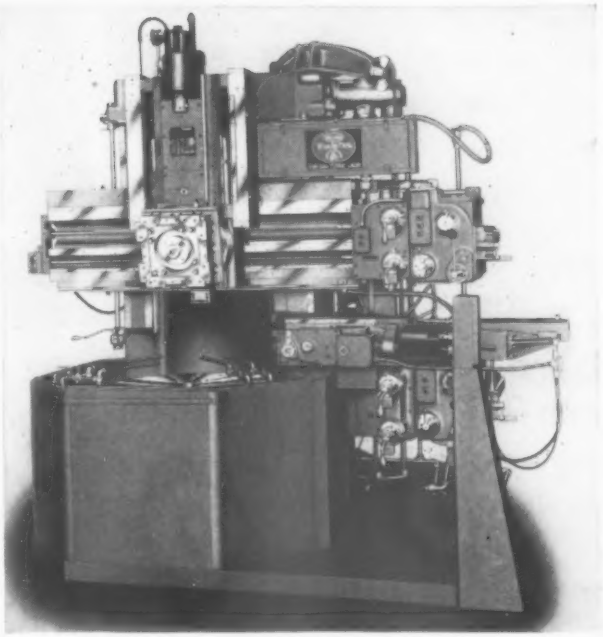
Man-Au-Trol — the word being derived from Manual or Automatic Control — has been found in actual service to possess many unique advantages over many previous methods of machining. Built into the Bullard Vertical Turret Lathe as a basic unit, the combination of this control with a sturdy base machine provides a fine degree of accuracy and a highly efficient production method.

Shortly after the introduction of the Man-Au-Trol Vertical Turret Lathe to the industries it was found that the machine and its tooling provided an economical and highly productive single spindle unit for the larger and heavier types of jobs requiring fine finish and a high degree of repetitive accuracy.

Man-Au-Trol Vertical Turret Lathes working today on high production for the defense program will readily and profitably adapt themselves to the easier pace of normal manufacturing procedures.

Versatility is only one of the many advantages of these machines and it will pay you now and in the future to investigate their possibilities in your plant.



Bullard Man-Au-Trol Vertical Turret Lathe — another step toward Greater Manufacturing Economy. Built in 30-, 36-, 42-, 54-, 64-, and 74-inch sizes.

BULLARD

THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT

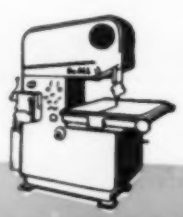
FRICTION

WORLD'S FASTEST, LOWEST COST METH

DONE BETTER WITH DoALL BAND MACHINES —BUILT FOR THE JOB!

DoALL ZEPHYR HIGH SPEED BAND MACHINES — the ideal machines for friction cut-off sawing and friction contour sawing everything from gray iron castings to stainless sheet. Speed range up to 15,000 blade feet per minute. Single or variable speed models available with throat capacities from 16″ to 60″.

DoALL CONTOUR-MATIC BAND MACHINE used for friction sawing stainless steel, Hastelloy "B" and other ferrous alloys at a large research laboratory. This machine has a speed range of 40 to 10,000 blade feet per minute. It can be used not only for friction sawing but also for sawing, slicing, grinding, honing, polishing and filing any known material. It will contour-machine any shape.



BAND MACHINES

SAW BANDS

GAGING EQUIPMENT

SURFACE GRIND

SAWING

OF CUTTING FERROUS METALS

DONE BETTER WITH DoALL FRICTION SAW BANDS... DESIGNED *EXCLUSIVELY* FOR THE JOB!

Actual size
½" wide, 10 pitch friction saw band

DoALL friction saw bands are manufactured in ½" and ¾" widths .032 gage and 1" .035 gage, 10 and 14 pitch. They are sold in 500 ft. coils in exclusive "strip-out" containers or in cut and welded lengths for use on all high speed band sawing machines at speeds from 3000 to 15,000 blade feet per minute.

FRICTION SAWING is a process wherein the friction created by the 3000 to 15,000 feet per minute band speeds softens the metal being cut, by heating it to its forging temperature directly ahead of the band teeth. The teeth bite easily into this softened metal, hogging it out much faster than if the metal were cold.

Friction Sawing provides amazingly fast cutting of ferrous metals, including hard-to-machine alloys. Sheet steel 1/16" thick can be cut at 140 linear feet per minute. One-inch material can be cut at speeds up to six lineal inches per minute.

The speed and economy of friction sawing is greatly dependent upon the saw band used. The tooth design, pitch, set, band width, thickness, steel alloy and heat treating of DoALL Friction Saw Bands are all specially designed for the job. A unique hardening technique is used to give longer set life and increase tooth strength. The metallurgical characteristics of the band are peaked for maximum flex life.

Here are the benefits of DoALL Friction Saw Band design, as compared to any standard or substitute metal cutting band:

1. Faster cutting rate.
2. Less operator fatigue.
3. Less burr.
4. Less heat penetration (excessive heat destroys desirable alloy characteristics).
5. Longer blade life on straight and radius cutting.
6. Less downtime for blade replacement.
7. Lower labor costs.
8. Lower production costs.

Tests have proved conclusively that when all factors, particularly labor costs, are taken into consideration, the cost of friction sawing with DoALL Friction Saw Bands is as much as 15 times lower than with bands not designed for the purpose.

For the fastest, lowest cost cutting of ferrous metals, use friction band sawing with *DoALL machines and saw bands.*

Call DoALL today—ask for free literature and a demonstration of friction sawing at your own plant.

SB-17

THE DoALL COMPANY
254 N. Laurel Avenue, Des Plaines, Illinois

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37 Clarkson Avenue, Toronto 10, Ontario, Canada

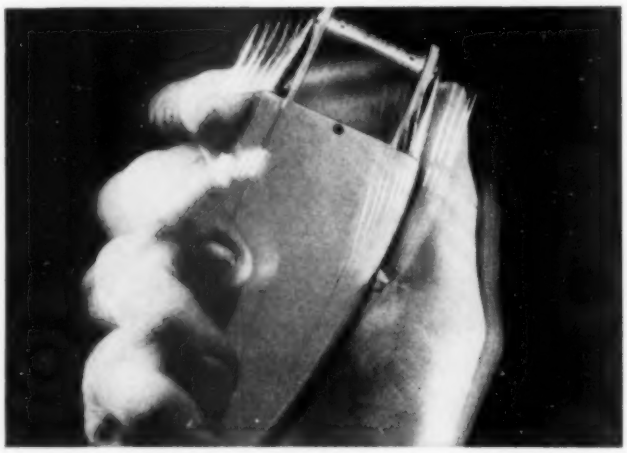
DoALL

38 Local Sales-Service Stores

FOR COMPLETE INFORMATION refer to the DoALL Band Tool Manual—a 160-page guidebook to better band machining of all materials. Price $2.00 at your local DoALL Store.

See DoALL equipment at the National Metal Exposition, Philadelphia, October 18-24. Booth 524 and 623.

Your key to TIGHTER assembly



...despite severe VIBRATION!

This Bristol wrench and Multiple-Spline Socket Screw is your key to tighter assembly despite severe vibration.

Here's why: Bristol's *exclusive* multiple-spline socket permits tightening beyond limit possible with any other type of screw . . . turns internal wrenching force into *rotary motion*, not expanding pressure. Hence, no bursting, no rounding out of socket walls—even in sizes down to No. 3, 2, 1, 0 wire.

Other advantages: Permits reduction in flange sizes . . . neater, more compact design . . . easy fastening in out-of-the-way places. A reverse flick of the wrench loosens the set, simplifies take-apart.

If your product must resist severe vibration, specify Bristol's Multiple-Spline Socket Screws.

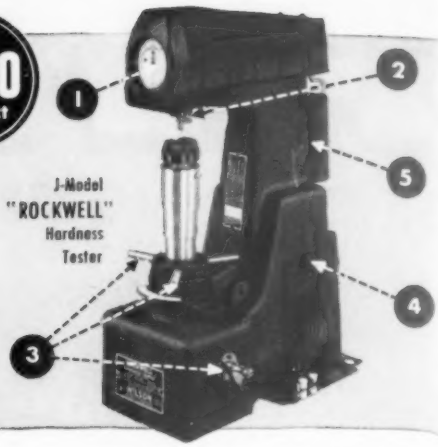
HEX SOCKET SCREWS, TOO . . .
Only Bristol gives you the right socket screw for every application.

BRISTOL'S SOCKET SCREWS

THE BRISTOL COMPANY, Socket Screw Division, Waterbury 20, Conn.

USE READER SERVICE CARD; INDICATE A-10-176-1

an ACCO product



J-Model "ROCKWELL" Hardness Tester

5 Important "ROCKWELL"* Features

1. Totally enclosed, dirt and dust-proof "Zerominder" dial gauge. 2. Gripsel clamp screw for quick change and proper setting of penetrator. 3. All controls grouped conveniently. 4. Enclosed, easy-to-reach, variable speed dash pot. 5. Standardized weights. These features assure accuracy and ease of operation.

There are two models of WILSON "ROCKWELL" Hardness Testers, plus the TUKON for micro-indentation hardness testing. Write for information.

*Trade Mark Registered

ACCO

WILSON MECHANICAL INSTRUMENT DIVISION
AMERICAN CHAIN & CABLE

WILSON "ROCKWELL" and TUKON Hardness Testers

230- Park Avenue, New York 17, N. Y.

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Severance Regrinding Service

RECONDITIONING TO NEW-TOOL PERFORMANCE AT A FRACTION OF NEW TOOL COST!

☆ HIGH SPEED and CARBIDE ☆

Why take less?-- for Safety, Efficiency, Economy-- insist on genuine factory reconditioning service performed by *Severance New Tool Craftsmen!*

CONSERVE CARBIDE TOOLING

THIS BEFORE AND AFTER PICTURE SHOWS WHAT OUR NEW-TOOL CRAFTSMEN CAN ACTUALLY DO WITH YOUR BATTERED CARBIDE TOOLS OF THIS AND SIMILAR TYPES

CONSERVE THROUGH REGRINDING

REPRESENTS A NEW SEVERANCE MIDGET MILL (HIGH SPEED OR CARBIDE)

REPRESENTS THE SAME TOOL AFTER 20 REGRINDS

YOUR DULL CUTTERS ARE REGROUND BY SEVERANCE NEW-TOOL CRAFTSMEN

CONSERVE THROUGH SALVAGE

YOUR DULL ROTARY FILES can be ground into MIDGET MILL TYPE TOOLS LIKE THIS

ELIMINATES LONG DELIVERY WORRIES-- Saves Your Dollars!

★ ★ We're the Originators ★ ★

OVER 20 YEARS EXPERIENCE IN THIS MONEY SAVING SERVICE

★ We've been copied but not surpassed ★

DEPENDABLE DELIVERIES ARE ASSURED ★ THROUGH SEVERANCE REGRINDING SERVICE

We Regrind: MIDGET MILLS, ROTARY FILES, BURS, FILE BANDS, COUNTERBORES, COUNTERSINKS, ETC.

SEND YOUR DULL CUTTERS TO

SEVERANCE TOOL INDUSTRIES INC.

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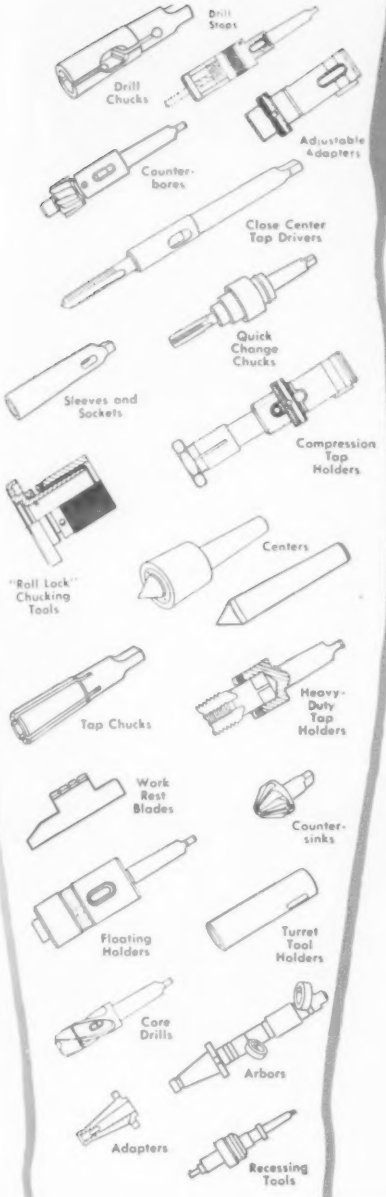


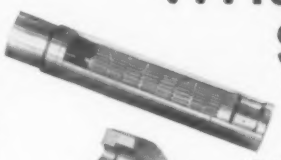
THE NEW CHUCKING TOOLS

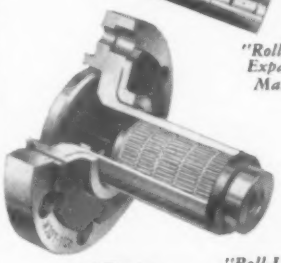
POWERFUL AND ACCURATE

. . . for precision work

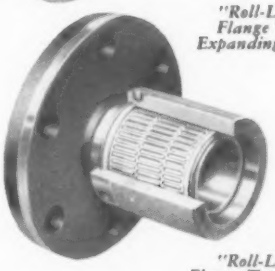
SCULLY-JONES

"ROLL-LOCK"* CHUCKING TOOLS





"Roll-Lock" Expanding Mandrel

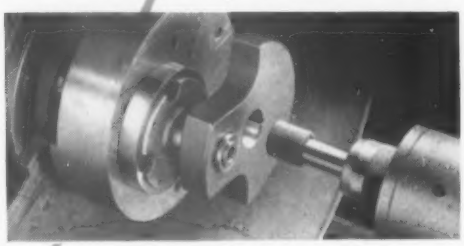


"Roll-Lock" Flange Type Expanding Arbor

"Roll-Lock" Flange Type Chuck

"Roll-Lock" Mandrels, Arbors and Chucks use a new chucking method for holding work or tools. This method takes advantage of the elastic properties of metal.

When a very little turning force is applied to actuating ring or cone, the powerful wedging action of rollers expands or compresses the chucking surface to a shrink fit. This permits maximum torque and thrust to be transmitted, assuring accuracy often less than .0001". "Roll-Lock" Chucking Tools are engaged or disengaged quickly and easily. Yet the shrink fit cannot be loosened by reversing the rotation of the tools or by shock and vibration.



Shown to the right are two of the many applications in turning, grinding or inspection operations. "Roll-Lock" Flange Type Expanding Arbor and Tool Chuck being used in a finish grinding machine for holding the work and grinding tool.

**"Roll-Lock" is a trade mark of Scully-Jones and Company.*

WRITE FOR BULLETIN No. 17-50
giving detailed description and technical data on these and other "Roll-Lock" Chucking Tools.

Scully-Jones AND COMPANY

1915 S. Rockwell St., Chicago 8, Ill.

R-5828

YOU GET LOW COST FAST ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS

the "ARMS and HANDS" for your MACHINE TOOLS

If you think of a Lathe, Mill, Multi-Spindle Machine, or other Machine Tools as being a human body, supplying power to the parts of the body doing the actual work, then Scully-Jones tools represent the "Arms and Hands"

YOUR PROBLEMS ARE OUR PROBLEMS

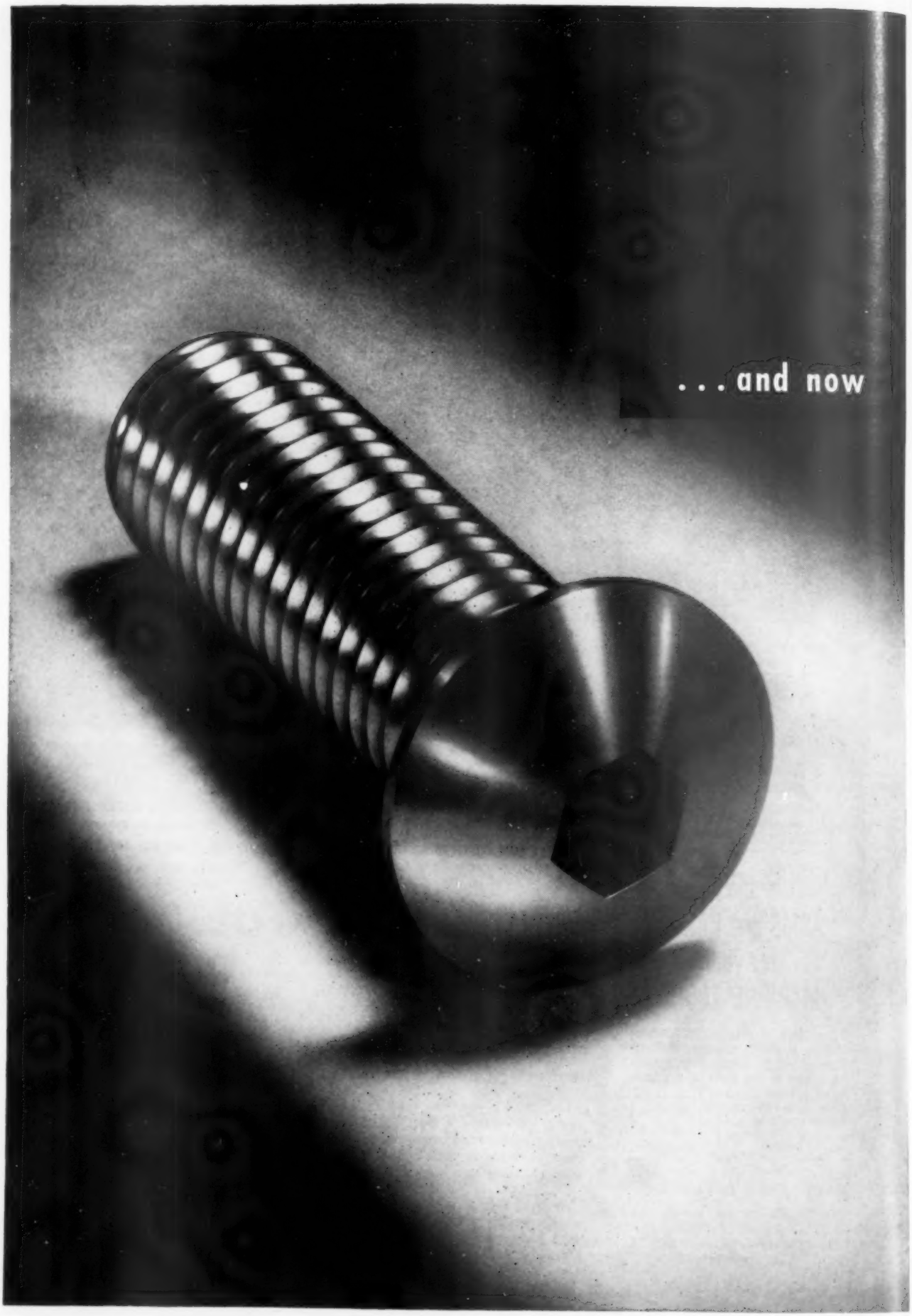
Helping you solve your tooling and production problems is Scully-Jones first objective. Ever since 1912 we have designed, developed and manufactured tools to the highest standards to help you get fast, accurate production at low cost.

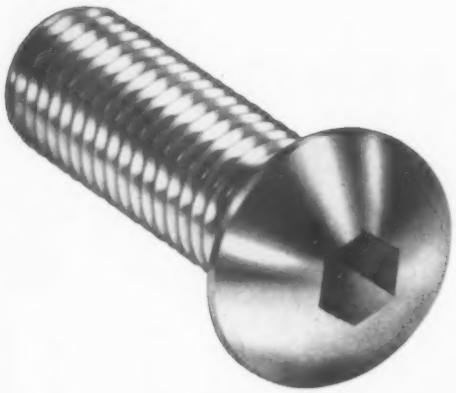
That is why you can purchase S-J Tools and get the best that engineering research, modern equipment, correct materials and expert workmanship can produce.

Use these S-J "Arms and Hands" to equip your machine tools. They will help you get low cost, fast, accurate production on such operations as drilling, reaming, tapping, milling, counterboring, countersinking, core drilling, recessing or undercutting, boring and grinding.

For current information on S-J Tools, refer to Catalog 600. Write on your company letterhead for your copy.

Let us help you solve your tooling and production problems. Because our manufacturing facilities have been expanded, we're in a position to give you reasonable deliveries. For quick service see our nearest representative or contact Scully-Jones direct.


. . . and now



UNBRAKO BUTTON HEAD SOCKET CAP SCREWS

These UNBRAKO screws are strong, accurate and uniform. They are designed for applications where countersinking is not practicable. They feature:

- **Head and threads concentric with the body**
- **Threads to head**
- **Low head height that streamlines design**
- **Nonslip drive that speeds assembly**
- **Nonburr socket that eliminates injuries from sharp splinters**
- **Class 3 fit—an UNBRAKO standard**
- **Stocks at your UNBRAKO industrial distributor**
- **Standard sizes—#8 through ⅝" diameter**

Write for literature. STANDARD PRESSED STEEL CO., Jenkintown 37, Pennsylvania.

UNBRAKO® SOCKET SCREW DIVISION

SPS

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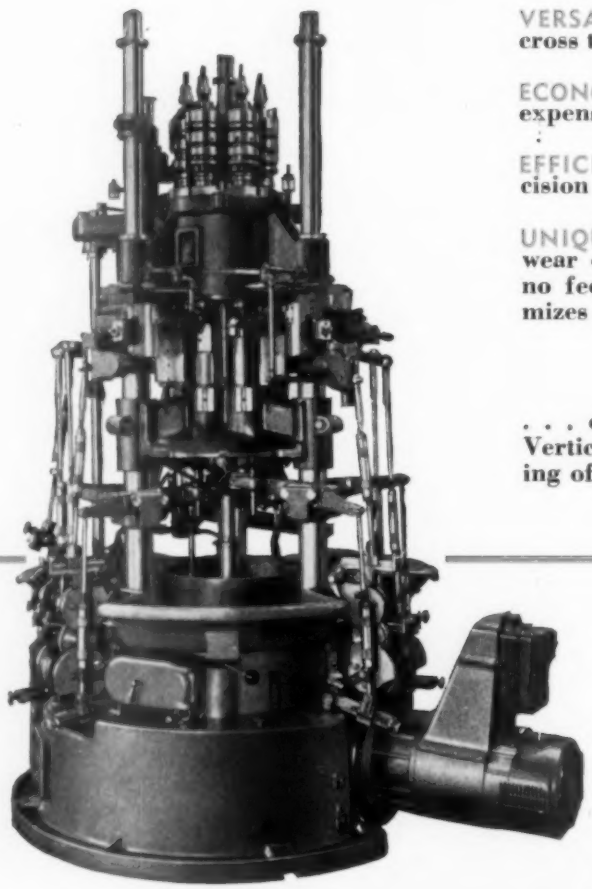
GYROMATIC
TAVANNES

THE IMPROVED 6 SPINDLE PRECISION

AUTOMATIC LATHE



GYROMATIC SIX-SPINDLE VERTICAL LATHE

(Shown without bar carrier and oil guards)

VERSATILE—**SIX rotating end tools and SIX cross tool slides.**

ECONOMICAL—**Both in tooling and set-up expense; uses comparatively little floor space.**

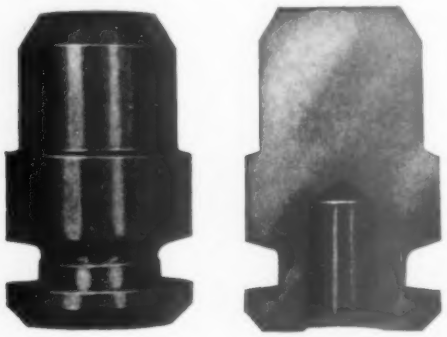
EFFICIENT—**High production, with built-in precision to meet exacting standards.**

UNIQUE DESIGN—**Vertical arrangement reduces wear of moving parts. Gravity bar feed requires no feed fingers, reduces load on spindles, minimizes vibration and noise.**

CHUCKING OPERATIONS

. . . can also be performed to great advantage. Vertical design permits easier loading and holding of work pieces.

Typical work piece taken from bars; capacity of 2⅝" dia. and 6" long.



AMERICAN REPRESENTATIVES

(UNITED STATES—EXCEPT WEST COAST)

RUSSELL, HOLBROOK & HENDERSON, INC.

292 MADISON AVENUE, NEW YORK 17, N. Y.

(CALIFORNIA, OREGON, WASHINGTON)

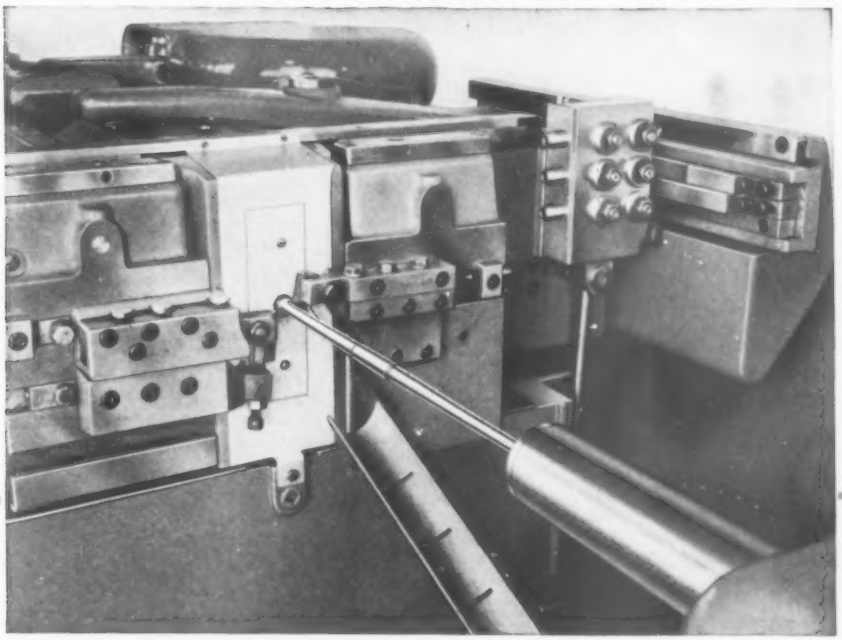
ART THOMAS MACHINERY CO.

2820 LEONIS BLVD., LOS ANGELES, CALIF.

TAVANNES

CAPACITIES TO
2 3/8" DIA. & 21 5/8" LENGTH

Single Spindle Automatic Lathe



View shows set-up to produce this 21⅝"-long piece.

Headstock feed permits all turning operations to be performed at point of support.

Rugged construction throughout. All tool adjustments readily accessible. Camming simple to make and apply.

SIX CROSS SLIDES
SIX END TOOLS

Precision • Flexibility • High Production by TAVANNES

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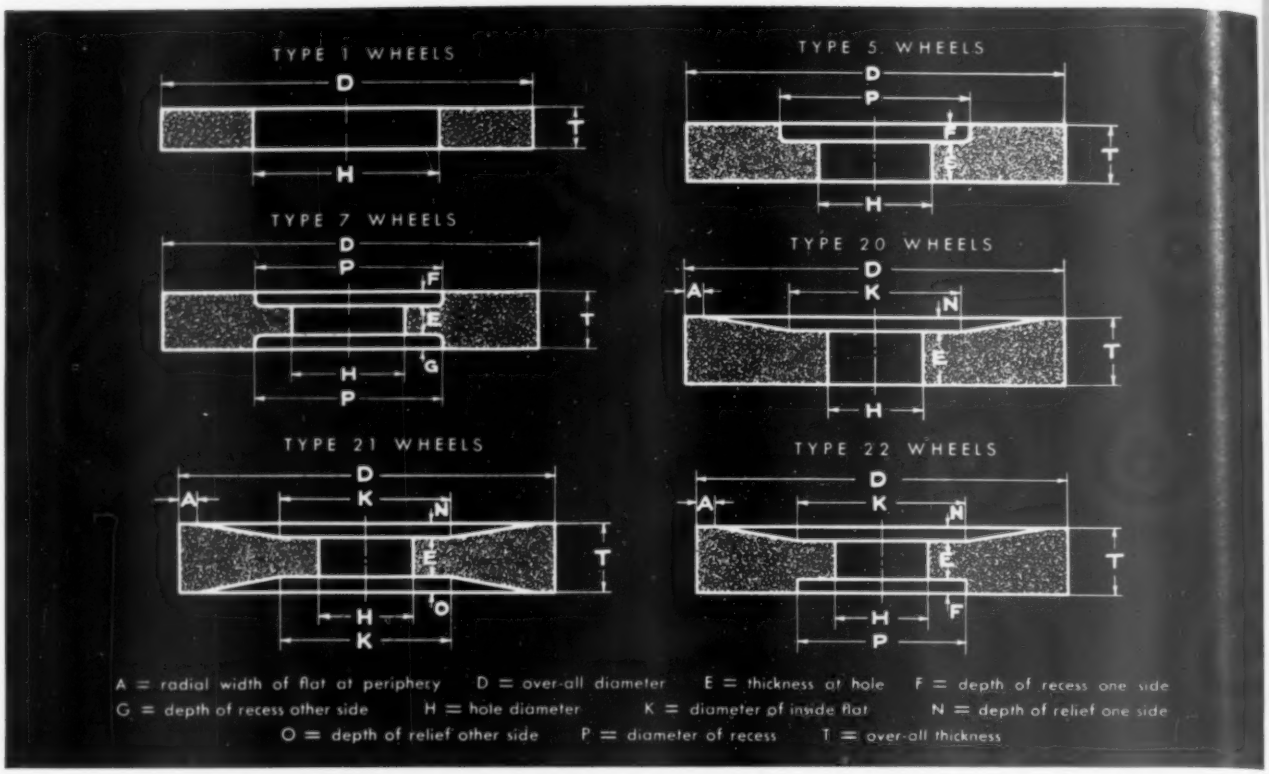


WHAT ARE STANDARD GRINDING WHEELS? They are the sizes and shapes selected by the National Bureau of Standards on the basis of: (1) widest use by industry; (2) widest range of adaptability to modern grinding equipment; and (3) most commonly carried in manufacturers' and distributors' stocks.

Specifically, in between-center cylindrical grinding wheels alone, there are 904 different "standards" in the six shapes shown above. For your convenience, they are listed in easy-to-read charts in "Standard Shapes and Sizes of Grinding Wheels" issued with the permission of the National Bureau of Standards.

It pays you 3 ways to use standard grinding wheels

Whatever types of grinding wheels you use, you can depend on "standards" to protect your investment. There are three reasons why:

1. *Standard sizes and shapes are more quickly available to you.* Grinding wheel manufacturers make them faster and in greater quantities . . . are more likely to have them in stock.

2. *Standard sizes and shapes help you keep inventories low.* No need to tie your money up in "specials."

3. *"Standards" give you the benefit of carefully engineered strength* at *all* vital points in *every* standard grinding wheel.

Why use non-standards — when standard sizes and shapes save you time, money, and trouble?

YOU'RE SURE YOU'RE RIGHT when you check your wheels against the simple standard charts in the bulletin "Standard Shapes and Sizes of Grinding Wheels." If you already have a copy, consult it. If you haven't, check the coupon below, and mail it today.

GRINDING WHEEL INSTITUTE, 2130 Keith Bldg., Cleveland 15, Ohio

Please send me:

Standard Shapes and Sizes of Grinding Wheels.

Also the following checked booklets to help me improve my use of grinding wheels:

☐ Safe Speeds for Grinding Wheels ☐ Safe Rules for Disc Grinding ☐ Mounting Techniques for Wheel Sleeves on Cylindrical Grinding Machines ☐ Safe Operation of Portable Grinding Machines ☐ Safe Rules for Handling, Storing and Inspecting Grinding Wheels ☐ Maintenance Recommendations of Heavy Speed, Heavy Duty Swing Frame and Floor Stand Grinding Machines ☐ Standard Specifications of Segments Used in Chucks ☐ Safety Code: The Use, Care and Protection of Abrasive Wheels

Name ..... *Title* .....

Address .....

City ..... *Zone* ..... *State* .....

OK Carbide Cutters mill vital "Thunderjet" forgings — II

As reported previously, Liberty Products Corporation, Farmingdale, L.I., produces the forged-steel bulkhead for Republic Aviation's F-84 "Thunderjet." This vital assembly provides the connection point for the wing spars, and hence every milling operation must be . . . properly performed — yet at minimum cost.

properly performed ... at minimum cost!"

SECOND OPERATION on these tough, heat-treated forgings involves milling the spar-connection bosses to proper thickness. To do this, the piece is clamped to a box-section fixture set up on a Kearney & Trecker No. D-11 duplex milling machine. The two bosses are milled with a 7-in. dia OK face mill having negative axial and radial rakes and fitted with carbide-tipped blades. Spindle speed is 200 rpm.; table feed 5.3 in. per min. This figures out to a cutting speed of 360 surface ft. per min., and a chip load of 0.0022 in. per tooth.

It is important that these bosses be smoothly milled to a thickness tolerance of 0.005 in. (actually 0.004 in. is easily maintained). Production amounts to three pieces per hour, both sides of two bosses being milled. Nine pieces are obtained per cutter grind.

Economical milling is realized throughout the Liberty Products plant by standardizing on OK cutters. Basic reasons for this choice are: OK cutters are *designed and made* so that each tooth takes its share of the load, resulting in smooth finishes and high metal-removal rates. The wedge-shaped blades require no locking devices. They can't pull out or twist to spoil the cut, but they can be removed quickly for replacement. By making blades interchangeable in several sizes of a specific type of cutter body, economy in stocking of blades is promoted.

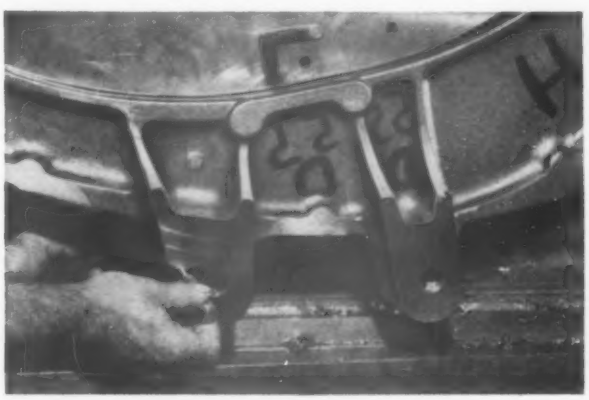
You may not be machining aircraft forgings to exacting specifications, but OK cutters will serve you just as efficiently regardless of material. We offer tools designed for negative or positive rakes, and supply high-speed steel, cast-alloy or cemented carbide blades.

When you get our complete story, you will see the logic of standardization on OK milling cutters, counterbores, facing heads, hollow mills, and reamers. Write for Catalog "Modern Milling Cutters for Modern Milling Machines."

OK

modern milling cutters for modern milling machines

THE OK TOOL COMPANY, MILFORD, N. H.



BIG '36' GEAR SHAPER cut

- The quick assumption that a machine with 36" dia. x 6" face width capacity would not be efficient on small gears... **IS WRONG!**

Here is specific evidence to the contrary: ----------

PHOTO BY COURTESY
NATIONAL ACME COMPANY
CLEVELAND, OHIO
Makers of Multiple-Spindle Bar and Chucking Machines

GEAR SHAPERS
SHAVING MACHINES
THREAD GENERATORS
CUTTERS AND SHAVING TOOLS
GEAR INSPECTION INSTRUMENTS

PLASTICS MOLDING MACHINES

MALL GEARS faster, too!

SPECIFICATIONS:

STEEL	SAE 4150
PITCH	8/10
PRESSURE ANGLE	20°
NO. OF TEETH	47
HELIX ANGLE	23°
TOOTH DEPTH	.235"

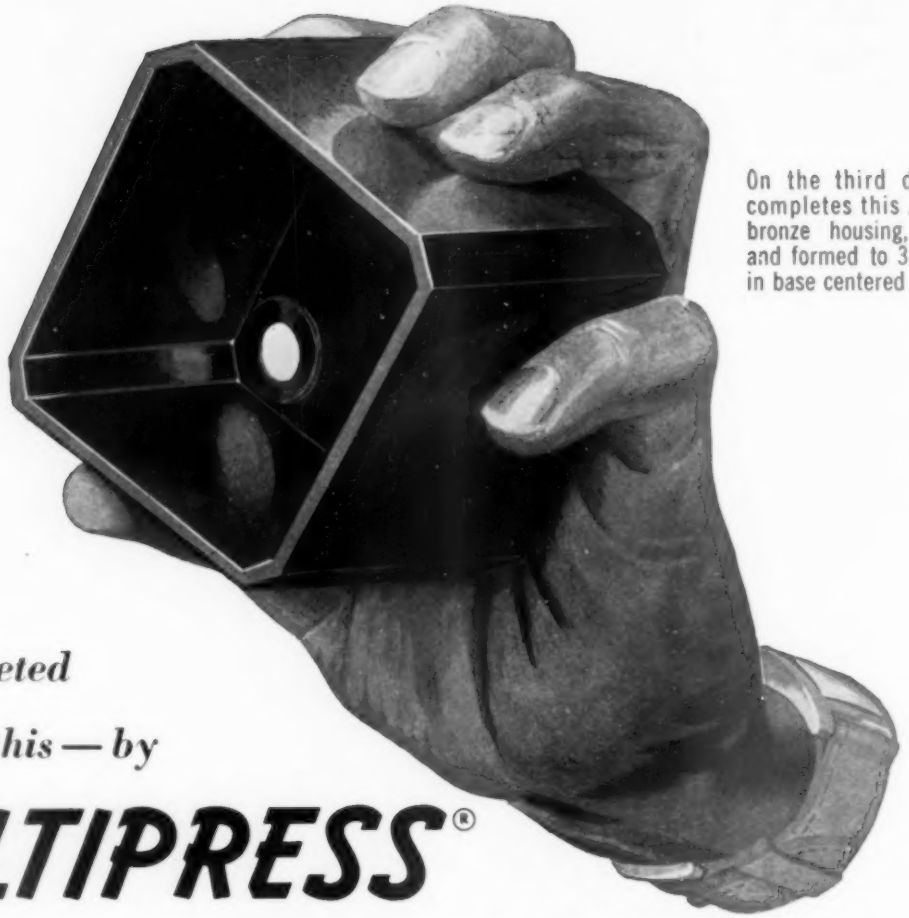
Cutting Time:
10 Minutes . . on the new 36-Type Gear Shaper

17.2 minutes . . . . . by next best alternate method
24 minutes . . . . . on still another machine
(all methods @ 2 gears per load, one cut)

This super-rigid big machine can take heavy cuts at high speed, and still hold fine finish . . . Work can be stacked up to 6" face width. Quick set-up, via shift-lever, dial-set and push-button controls. Choice of 12 cutter spindle speeds (18 to 300 strokes per min.) and 12 rotary feeds . . . The most versatile of all-purpose Gear-shapers! . . . *Contact our nearest representative for additional information. He will be glad to assist you in lowering your gear production costs.*

Fellows

THE FELLOWS GEAR SHAPER COMPANY • Head Office and Export Department • 78 River Street, Springfield, Vermont
Branch Offices: 323 Fisher Bldg., Detroit 2 • 5835 West North Avenue, Chicago 39 • 2206 Empire State Bldg., New York 1



On the third draw Multipress completes this .064 phosphorus bronze housing, precision-drawn and formed to 3-inch depth, hole in base centered in embossed ring.

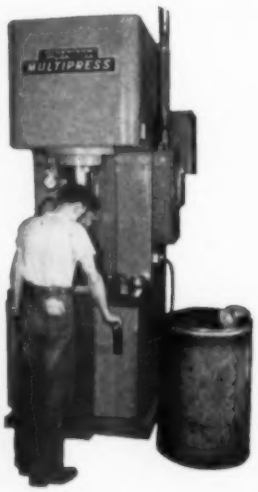
Completed

like this — by

MULTIPRESS®

on the THIRD DRAW

Deep-drawing jobs average 50% FASTER at Hudson Tool and Die



Multipress offers eight frame sizes... one to 50-ton capacities . . . manual or automatic controls . . . index-table, dial, and harmonic stock feeds . . . many other standard accessories for special needs.

With the smooth, rapid, *controlled action* of oil-hydraulic power, Multipress takes its usual big bite out of production costs for another new user — the Hudson Tool & Die Company, Newark, N. J. The company specializes in accurately drawn shapes of steel, phosphorus bronze, brass, and copper.

A 50-ton Multipress with standard punch and draw ring does *better* work in *fewer stages* than the press used previously — *with less metal fracture than before.* Draws average 20% deeper . . . production is up from 600 units per hour to an average of 900 per hour . . . quality is better than ever . . . highest safety is assured by dual hand-lever controls . . . and unskilled workmen get perfect results from the start because Multipress permits infinite adjustment of ram *pressure, speed* and *stroke* for each operation.

(Hudson Tool & Die already has a second Multipress on order, as this is written, and is planning for additional units in the near future.)

Other plants report equally remarkable savings and short cuts — not only on *drawing* jobs, but also in broaching, forming, bending, stamping, staking, crimping, flaring, riveting and many other operations. Write today for full information.

THE **DENISON** ENGINEERING CO.

DENISON HydrOILics

1191 Dublin Road
Columbus 16, Ohio

End Oversize and Bell-Mouthed Holes!

Types to fit any machine used for tapping or reaming.

In tapping and reaming it is a simple matter to eliminate oversize and bell-mouthed holes which result from carelessness in aligning the work with the spindle.

By using a Ziegler Floating Holder which automatically compensates for spindle misalignment of as much as 1/32" radius or 1/16" diameter, work can still be turned out to the finest tolerances in spite of inaccurate set-up.

Instead of writing off spoilage losses day after day on tapping and reaming jobs, why not put an end to them by changing over to Ziegler Floating Holders? You'll find that they'll repay their cost in a remarkably short time.

W. M. ZIEGLER TOOL COMPANY

13574 AUBURN DETROIT 23, MICH.

Ziegler ROLLER DRIVE FLOATING HOLDER for Taps and Reamers...

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TOOL AND PROCESS ENGINEERS

MEN EXPERIENCED IN METAL FABRICATION CAN HAVE EXCELLENT OPPORTUNITIES OFFERED BY

REYNOLDS METALS CO.

PIONEERS OF PROGRESS IN

ALUMINUM

PAID INTERVIEW EXPENSE
PAID MOVING EXPENSE
EXCELLENT EMPLOYEE BENEFITS

WRITE, GIVING EXPERIENCE AND TRAINING TO:
SALARIED PERSONNEL OFFICE

REYNOLDS METALS CO.
2000 SOUTH NINTH
LOUISVILLE, KENTUCKY

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This camera helped ALLIS-CHALMERS design better circuit breakers

Contacts in this oil-filled, high-voltage circuit breaker open and close in a quarter second—much too fast to see. To study this action, Allis-Chalmers engineers use the Kodak High Speed Camera, shooting through a special transparent manhole.

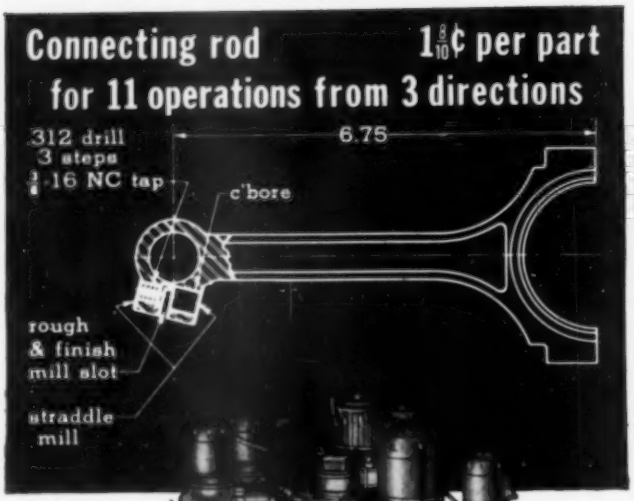
The 16mm films, taken at speeds up to 3200 frames per second, are projected at normal speed—slow the motion as much as 200 times. What appeared as a blur during the test is transformed on the screen into a close-up, slowed-down view of the action for detailed study and analysis.

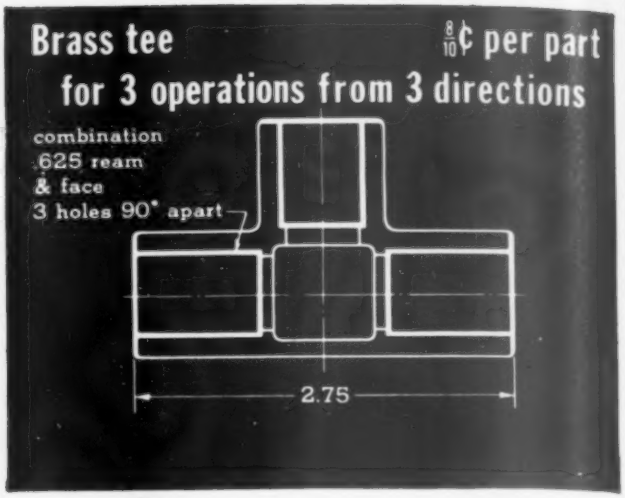
The Kodak High Speed Camera is daily solving complex design, production, and performance problems where high speed mechanical action or fluid flow is involved. To see how this versatile instrument can help you save time and money, send for your copy of a booklet giving complete information. Or, write for details about a new 16mm sound movie, "Magnifying Time." Eastman Kodak Company, Industrial Photographic Division, Rochester 4, N. Y.

the Kodak HIGH SPEED Camera

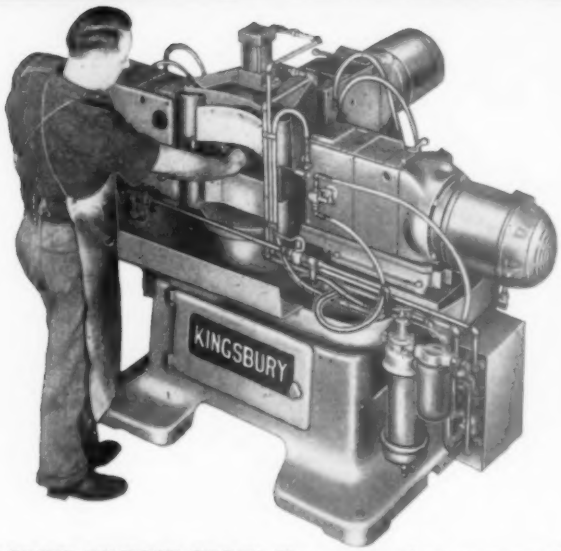
Kodak
TRADE-MARK

USE READER SERVICE CARD; INDICATE A-10-187-3





500 PARTS AN HOUR GROSS. Each fixture on this 60-inch "Auto-Index" holds two parts. Horizontal units mill both parts with one cutter. Vertical units on the central column do the holes with two-spindle heads; the counterboring head is inverted.



500 PARTS AN HOUR GROSS. The operator just removes a finished part, replaces it and presses a lever. The machine automatically clamps the work, operates the opposed tools and then the third tool and unclamps the work. There is no indexing.

How much do you pay for

A study of four special drilling and tapping machines that produce at the same rate: 500 parts an hour gross

Dear Sir:

At 80% efficiency each of these Kingsburys averages one finished part every nine seconds. What would that much production cost you?

Each drawing shows the cost for the man and his Kingsbury — no power or overhead. The cost for each man is the same — one 400th part of today's national hourly wage rate. (The 400 is from 3600 secs. in an hour ÷ 9.)

The difference in costs is in the machines, of course. Notice how small this difference is — just one cent between the highest and the lowest, the Connecting Rod and the Brass Tee.

What a difference

Yet the total price of the Rod machine is *seven times* that of the Tee machine. The Rod machine is a massive affair — an 84-inch base with four knees and a central column, nine operating units and a 60-inch power index unit with ten work fixtures that alone weigh 1.2 tons. The Tee machine has just a 68-inch base, three drilling units and one work fixture.

But in unit costs the difference is just one cent, on the basis of amortizing the entire investments in machine and tooling over 6000 hours, a fraction of the useful lives.

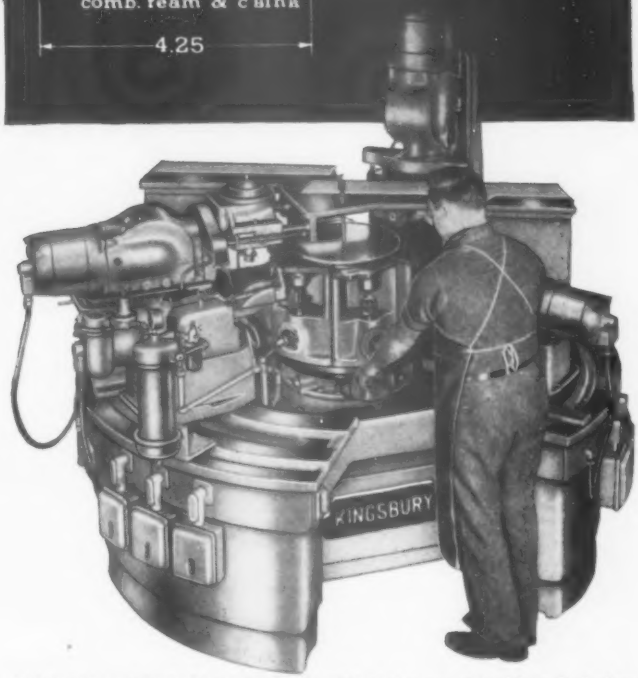
Naturally your figuring might be different. But on a high production basis your costs should be close to ours. With low production — well, that's something else again.

Meets your specifications

All four of these Kingsburys have the same hourly production rate — 500 parts gross or 400 parts at 80% efficiency. We picked them this way on purpose for this comparison.

Actually we design, build and tool each machine to meet each customer's specifications — the operations he

500 PARTS AN HOUR GROSS. A 20-inch power index table has seven fixtures. Three horizontal units end mill and drill the long .120 hole. The inverted angular unit drills two .120 holes. Two hidden angular units drill and ream the .188 hole.



500 PARTS AN HOUR GROSS. All units on this 20-inch index machine are off the radial lines through the fixtures. Three horizontal units for the hole are 20° left. Another for the slot is 30° right. The vertical unit that mills the notch is 10° right.

9 seconds of production?

names, the production rate he names.

Among other things, each of these customers wanted operations from three directions in one chucking. It was easy for the Brass Tee since each hole needed just one operation. A non-index machine with three automatic drilling units did the trick.

It takes ingenuity

The other three machines had index tables, so it took more ingenuity to work from three directions. The Connecting Rod machine has the usual horizontal and vertical units plus a vertical unit with an inverted auxiliary head that counterbores from below. The units for the Crankshaft are horizontal and at two different angles. For the Distributor Base one unit is vertical and the others are horizontal but at angles to the radial center lines through the work fixtures.

That is, of course, just part of the problem. It takes ingenuity to design a fixture that will hold the work firmly, locate it properly, and still leave room for the tools to operate and the chips to escape. It takes ingenuity to mount all fixtures in exact location on the index table so that all finished parts are fully accurate and uniform. It takes ingenuity on this type of equipment to locate tools to close tolerances.

We feel sure we have the ingenuity to design, build and tool a machine that will meet your requirements.

Sincerely,
Kingsbury Machine Tool Corp.
97 Laurel Street, Keene, N. H.

KINGSBURY

AUTOMATIC DRILLING & TAPPING MACHINES
for Low-Cost High Production

Gaging Costs Less

with a TAFT-PEIRCE CompAIRator AIR GAGE

It's FASTER

A Taft-Peirce CompAIRator reads instantaneously to .0001" or less . . . without mechanical contact . . . without flutter or creep. There's virtually no time lag even when gaging at considerable distance from unit.

It's More VERSATILE

Ideal for any type of production measurement from simple diameters to complex multi-dimensional checks. Supersensitive, it can be used in checking alignment, flatness, concentricities, squareness of bore to face, center distances, and tapers.

It's More ECONOMICAL

Eliminates wear of gaging members...saves constant checking and replacement. Little or no maintenance is required.

It's SIMPLE

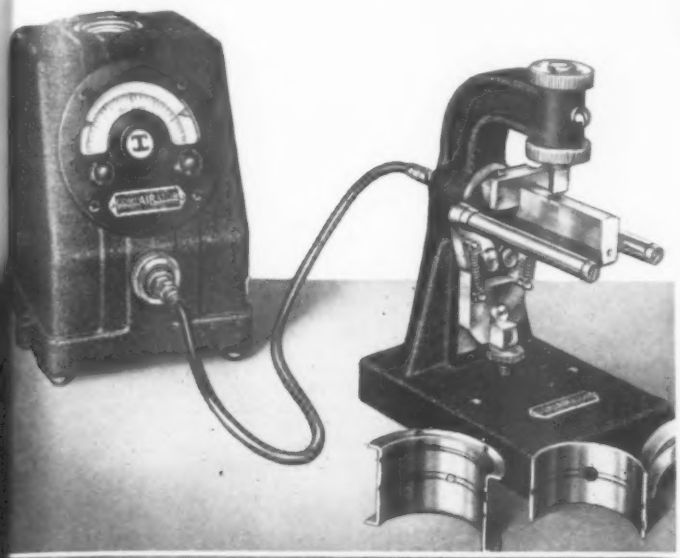
Anyone who can read a dial can operate a T-P CompAIRator. What's more, it's portable, easy to adjust, and can be equipped with any one of several standard dials and amplifications.

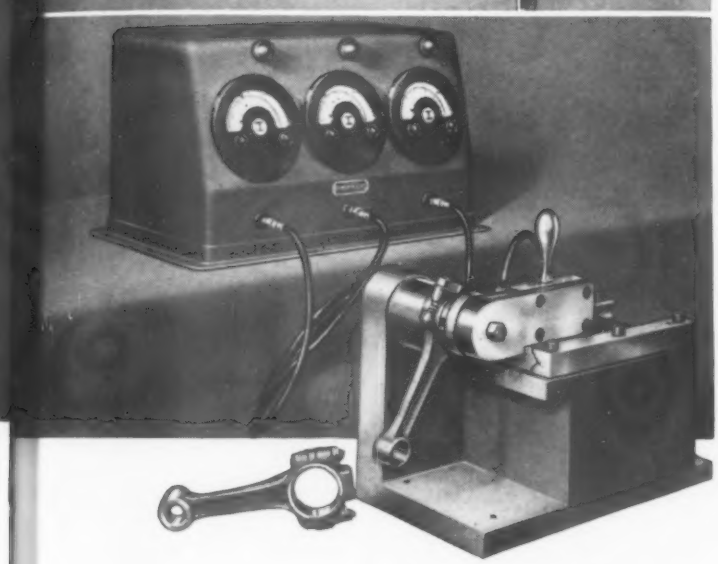
It's DEPENDABLE

Vibration, jarring, tilting will not disturb accuracy . . . nor will sludge or coolant flow —air pressure automatically clears gaging area.

Write today for Bulletin

T-P Single Dial CompAIRator
checking wall thickness of bearing liners. Special fixture adjusts to check range of bearing sizes.



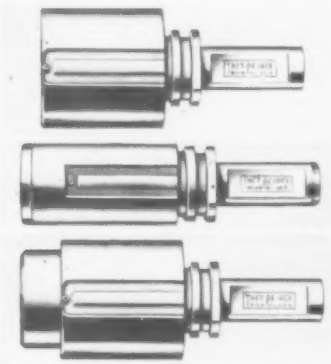


T-P Triple Dial CompAIRator
measures face squareness (to hole), hole size, and face width of connecting rod, in one pass.

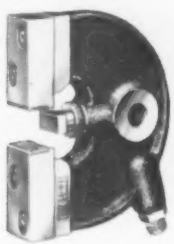
Standard Accessories

T-P HORIZONTAL STANDS. Excellent for bench inspection or use with large plugs, they facilitate gaging at a distance from indicator.

T-P VERTICAL STANDS speed measurements in vertical plane. Special fixtures are designed and built on request.



T-P GAGE PLUGS
available for thru holes, blind holes, and counterbores, from .055″ D upward. Also with Emmerton, bullet-nose, or Taft-Peirce pilots.



T-P AIR GAGE RINGS for external diameters .125″ up. Available with 3 nozzles instead of 2 for centerless ground work.

T-P ADJUSTABLE AIR SNAP GAGES available in range from .125″ to 6¾″. Anvils have ⅜″ range of adjustment.

T-P EXTENSION TUBES furnished in 2, 4, 6, and 10 foot lengths for hand or fixture gaging.

T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY
WOONSOCKET, RHODE ISLAND

STOP THE BIGGEST THIEF IN AMERICA

OAKITE GIVES YOU THREE WAYS TO FIGHT RUST

Day and night—wherever your steel is stored or handled—RUST, the biggest thief in America, is robbing you of production, robbing you of profit.

Oakite can help you defeat rust these three ways:

☆ **1 By removing rust from raw steel**—often eliminating pickling by removing rust and oil in one operation.

☆ **2 By preventing rust during processing**—protecting your steel all the way from stamping to shipping.

☆ **3 By preventing under-coat rusting of painted products**—combining cleaning, paint-conditioning and rust-prevention in one operation.

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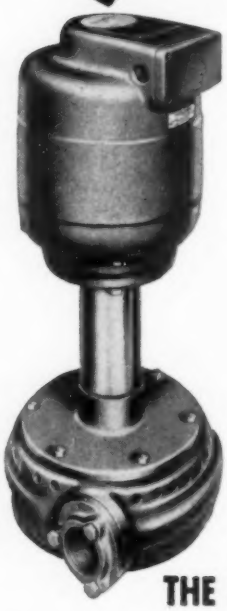
OK'ed by The Leaders



RUTHMAN GUSHER COOLANT PUMPS

Here is why leading machine tool manufacturers continually use Gusher Pumps as standard equipment on their machines. Gusher Pumps deliver instantaneous coolant flow . . . no packing or priming is necessary . . . pre-lubricated heavy-duty ball-bearings require no further attention . . . maintenance cost is cut to a minimum. Electronically balanced rotating assembly plus overall simple construction reduces wear.

Follow the leaders — Specify Gusher Coolant Pumps.

THE RUTHMAN MACHINERY CO.

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Features **2** Standards

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Simplifies, speeds bushing selection. Packed with valuable data. Saves you time and trouble. Also includes liners, leader pins, dowel pins, locating jigs, etc.

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Serving Industry For 28 Years

MANUFACTURERS OF DRILL JIG AND FIXTURE BUSHINGS

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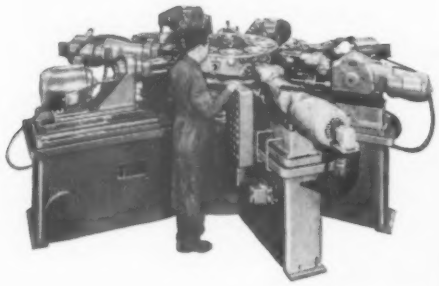
closeups of drilling & tapping PRODUCTION



The Hartford Special machine above is drilling, tapping and chamfering side pad holes in compressor rear frames.

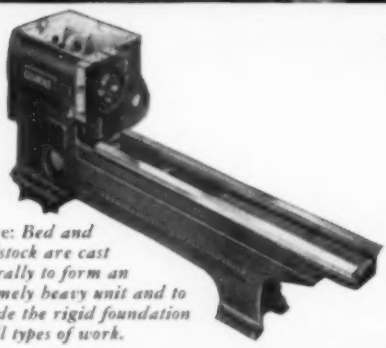
The machine at the left, using a vertical dial, is core drilling, rough and finish reaming, rough and finish facing and chamfering two rockers simultaneously.

When it comes to production — **HARTFORD** *Special*

SUPER-SPACERS

Automatic THREAD ROLLERS

THE HARTFORD SPECIAL MACHINERY CO., HARTFORD 12, CONN.



Above: *Bed and Headstock are cast integrally to form an extremely heavy unit and to provide the rigid foundation for all types of work.*

Below: *Block type ways are straddle keyed to the bed and ground in perfect alignment with the spindle. All working surfaces are hardened to 64-66 Rockwell "C".*

ACCURACY THAT DOESN'T "WEAR OFF"

Here are two good reasons why you can count on the accuracy of Gisholt Turret Lathes—now and years from now.

One-piece bed and headstock, cast as a heavy, rigid unit, reduce distortion and vibration to a minimum. Headstock is jig-bored to insure—and maintain—perfect alignment of spindle and drive shafts, with ample metal to provide the most solid support possible.

Hardened steel ways are augmented by hardened steel strips secured to the ram saddle, as well as hardened steel gibs and clamps, making an assembly that is virtually wear-proof. Its accuracy is further preserved by force lubrication.

These advantages are yours for the long life of any Gisholt Turret Lathe. Ask for complete details.

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

GROUND OR ACCURATE UNGROUND?

Inter-Departmental Memorandum

From: Factory Superintendent

To: Purchasing

Subject: Lower Hobbing Costs

Better check with Michigan Tool or their representative in our area. They have a new process for making even more accurate unground hobs.

We might be able to cut hobbing costs on some of our jobs with these. Ask them for their Bulletin H-52. It shows their tolerances for both the ground and newest accurate unground types.

MICHIGAN TOOL Company

7171 E. McNICHOLS RD. • DETROIT 12, MICHIGAN, U. S. A.

Mark Twain!

Mississippi Pilots Use Marking Devices

Samuel Clemens adopted his pen name from the expression used by Mississippi River Pilots, such as he, indicating the 2 Fathom Marking Device affixed to their lead lines.

CADILLAC MARKING DEVICES

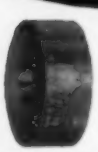
are Designed for

ALL MARKING PURPOSES

Whatever your requirements, from small Hand Stamps to Pneumatic, Hydraulic or especially created Marking Machinery, CADILLAC STAMP COMPANY stands ready to supply or design and build to meet your needs.

CADILLAC 45 HYDRAULIC MARKING MACHINES

Compact, self-contained, manifold mounted. One control gives full range of marking depth. It will mark round, flat and irregular surfaces. Machine capacity is up to 110 one inch impressions per minute.



SOLID ROLL DIE
Assuring the utmost in accuracy—used in marking machines, lathes and screw machines.

PUNCH PRESS DIE
Faithfully reproduces and is particularly adapted to large production marking.

ROLL TYPE HOLDER
Depending on requirements, can be had for either solid or interchangeable type.

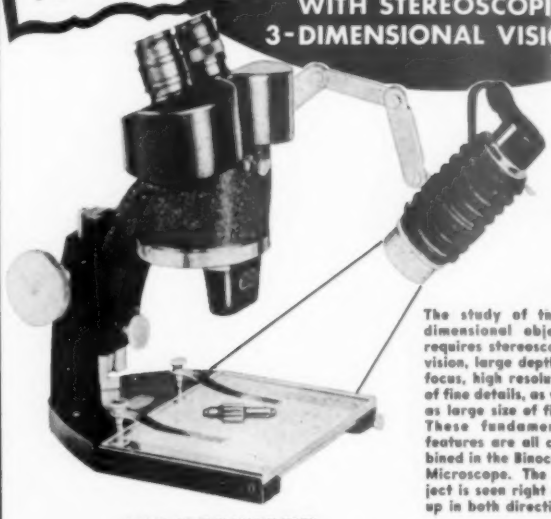
CADILLAC STAMP CO.
17313 RYAN ROAD • DETROIT 12, MICH.
3000 IRVING PARK • CHICAGO 18, ILLINOIS

USE READER SERVICE CARD; INDICATE A-10-196-1

A NECESSITY For Every Shop

BINOCULAR MICROSCOPE

WITH STEREOSCOPIC 3-DIMENSIONAL VISION



The study of three dimensional objects requires stereoscopic vision, large depth of focus, high resolution of fine details, as well as large size of field. These fundamental features are all combined in the Binocular Microscope. The object is seen right side up in both directions.

SOME OF THE MANY USES

Balls and ball races for pits and flats, edges of razor blades and surgical knives, radio tube parts, watchparts, jewels; tools of all kinds; and control of surface finish in grinding and lapping operations.

WRITE FOR ILLUSTRATED FOLDER

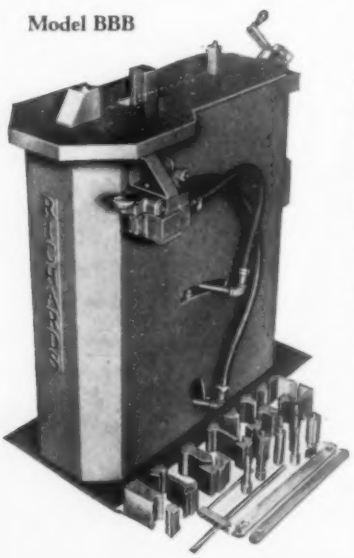
GEORGE SCHERR CO., Inc.
COMPLETE LINE OF PRECISION INSTRUMENTS
200C LAFAYETTE ST. • N.Y. 12, N.Y.

USE READER SERVICE CARD; INDICATE A-10-196-2

MULTIFORM BIG BROTHER BENDER

Produces Without Special Tooling—Saves Die Costs Saves on Expensive Presses

Model BBB



Illustrated above are a few of the many forms that can be produced efficiently on the Multiform Bender, using the standard tooling.

The heavy duty Big Brother Bender is designed for fabricating bus bars, brackets, fixtures, etc., without special tooling. Air controlled with finger tip response. Comes complete with dies, mandrels and wrenches—punching and blanking dies extra. Will punch holes up to 1" and form material up to ¼" thick by 4" wide. We also build smaller hand or air operated models for forming up to ⅜"x1½" material.

Send for illustrated folder TE-5

J. A. RICHARDS CO. 903 North Pitcher St. Kalamazoo, Michigan

USE READER SERVICE CARD; INDICATE A-10-196-3

we won our first letter in tool steel

We all remember with pride our first triumphs. Ours was with tool steel. And after a half-century, Crucible is still the nation's top producer.

Therefore, we are keeping our research and development right in step with industry's progress. We are making our experience available to you, with freely offered metallurgical advice. And we provide quick delivery from a fully-stocked warehouse located near *you*.

SEND TODAY for the unique Crucible Tool Steel Selector—a twist of the dial gives the tool steel for your application.

Rex® High Speed Steels
Peerless Hot Work Steels
Halcomb 218
Chro-Mow®
Sanderson Carbon Tool Steels
Ketos®
AirKool Die Steel
Airdi® 150
Nu-Die V Die Casting Steel
CSM 2 Mold Steel
La Belle® Silicon #2
Atha Pneu

SPECIFY YOUR TOOL STEELS BY THESE BRAND NAMES

Crucible Steel Company of America
Dept. T, Chrysler Building, New York 17, N. Y.
Name_____
Company_____ Title_____
Address_____ City_____ State_____

9" diameter, 3-colors

CRUCIBLE first name in special purpose steels

52 years of Fine steelmaking

TOOL STEELS

CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.

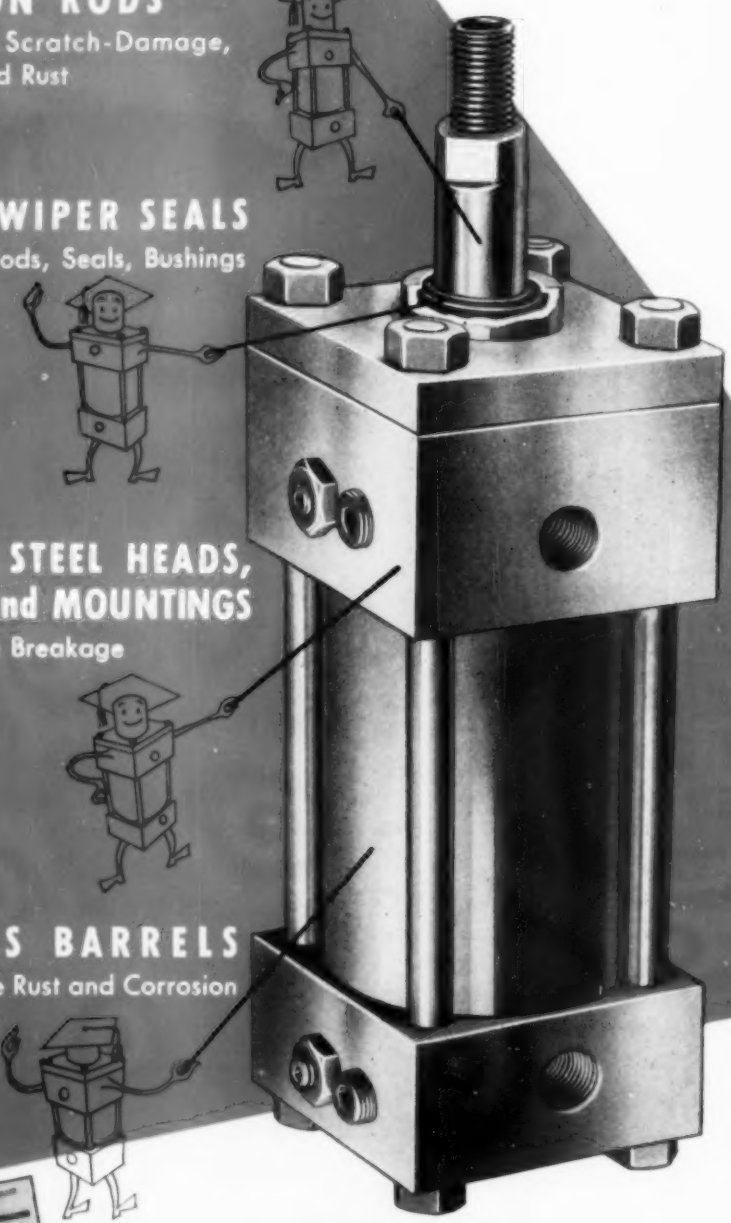
Miller — AIR CYLINDER

HARD CHROME PLATED PISTON RODS
Prevent Scratch-Damage, Nicks and Rust

DIRT WIPER SEALS
Protect Rods, Seals, Bushings

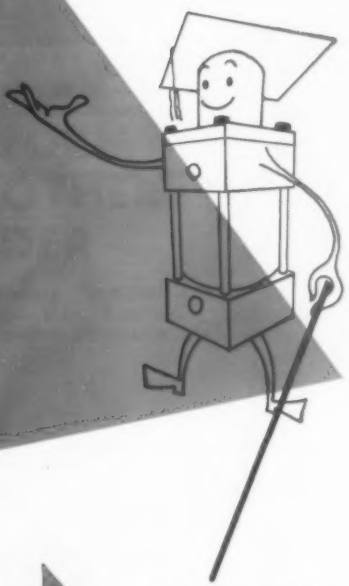
SOLID STEEL HEADS, CAPS and MOUNTINGS
Eliminate Breakage

BRASS BARRELS
Eliminate Rust and Corrosion



FOUR WEEK DELIVERY to meet your *RUSH* cylinder requirements

. . . now assured by our modern new plant with greatly expanded facilities—devoted exclusively to the manufacture of quality cylinders.



MET J. I. C. PNEUMAT STANDARDS years bef their adoption in 1950.

SPACE-SAVING SQUA DESIGN originated by Mil in 1945.

WRITE FOR CYLINDER BULLETINS A-105 and H-104

Complete Miller cylinder line includes: air cylinders, 1½" to 20" bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

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Miller

MILLER MOTOR COMPA

2010 N. HAWTHORNE AVE. • MELROSE PARK

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACC

Using a special rotary fixture, the Le Roi Company taps Class 4 threads in one operation on a Warner & Swasey No. 12 Precision Tapping and Threading Machine.

Class 4 threads at one pass!

AND SCRAP LOSS LESS THAN 1%

A HIGHLY ACCURATE tapping job—a ½-20 thread to Class 4 fit through a $^{9}/_{16}$″ crankshaft flange—is required in manufacturing industrial gasoline engines at the Le Roi Company, West Allis, Wisconsin. This important job, done by the previous method, required a rough tap by machine and then finish by hand. And despite operators' care and skill, one crankshaft in every ten had to be scrapped.

When a Warner & Swasey No. 12 Precision Tapping and Threading Machine was put on this same job, Le Roi cut scrap losses to the vanishing point—less than 1%. And this accurate machine taps the Class 4 fits in one pass, eliminating all costly handwork.

It wasn't too long ago that it would have been considered impossible to cut Class 3 and 4 threads consistently by machine alone. But results at the Le Roi Company bear out the experience of hundreds of plants where Warner & Swasey Precision Tapping and Threading Machines have set new standards of accuracy.

If you have tough tapping or threading jobs, in hard or soft metals or plastics, let a Warner & Swasey Field Engineer show you how a Precision Tapping and Threading Machine can help you cut scrap losses and get better, more profitable production.

WARNER & SWASEY *Cleveland*

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY TURRET LATHES, AUTOMATICS AND TAPPING MACHINES

NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-ACTION IN DEVELOPING POSSIBILITIES IN PRODUCT

© LE Co. 1952

WELDED DESIGN INCREASES RIGIDITY WITHOUT INCREASING COST

By **Eric Hartmann,** Experimental Research Engineer
The Porter Cable Machine Co., Syracuse, New York

BY changing over the design of our belt platen support to welded steel construction, we have cut deflection over 90%. The former cast construction, (Fig. 1) would deflect from .017" to .020" under 400 pound table pressure. The present welded steel design deflects only .0015" to .002" ... 10% of its original value.

Since steel is 2½ times more rigid than gray iron, it was possible to develop a more efficient product design on the platen itself without changing the basic dimensions of the machine or without increasing costs. On machine tools like ours, rigidity is basically important as it directly affects ultimate accuracy and efficient operation of the equipment.

Fig. 3—Detail of Column *on Porter Cable BG-8 Grinder. Shows assembly of belt platen support governing the ultimate accuracy and efficiency of the machine.*

Inset: Rear view of welded steel platen. *Shows efficient use of steel to achieve maximum strength and rigidity per pound of metal.*

WELDED DESIGN ALWAYS SAVES STEEL AND LOWERS COST

Fig. 1—Former Design—*Belt platen support for grinder was originally a casting. Required machining operations to finish the front face and the mounting arms.*

Fig. 2—Present Design in Welded Steel—*Is simpler to fabricate than the original construction. Components are pre-machined prior to welded assembly to simplify manufacture.*

HERE'S HOW

Machine Design Sheets free on request. Designers and Engineers write on your letterhead to Dept. 365

THE LINCOLN ELECTRIC COMPANY

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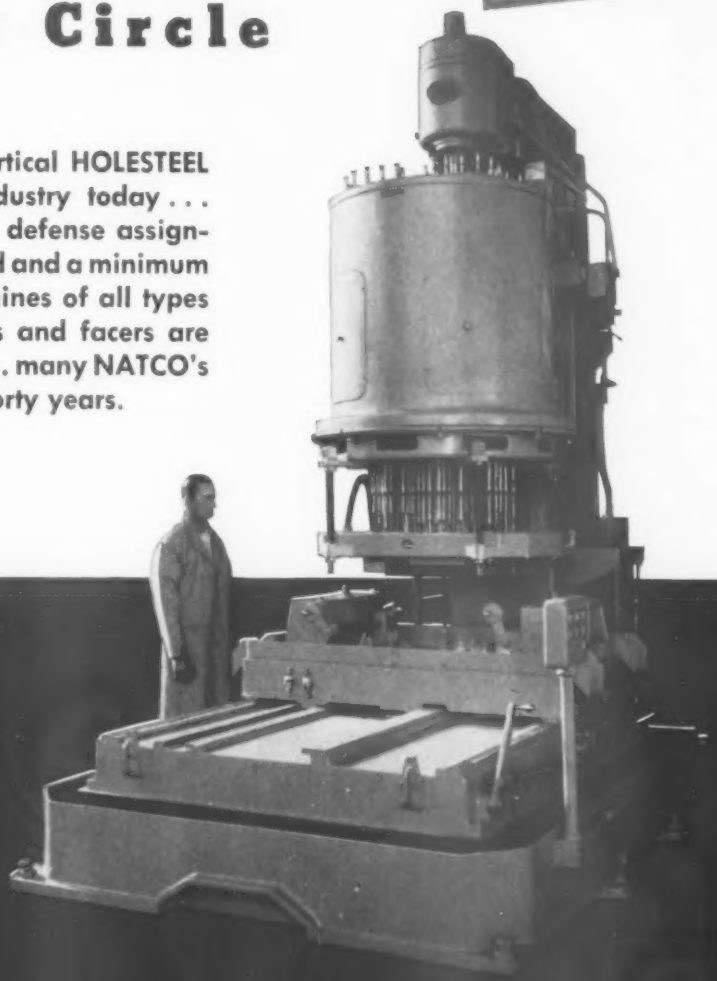
THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

MAMMOTH NATCO

Drilling 50 Holes on 36" Bolt Circle

Natco Engineered for Quality Production

NATCO Model C4B Vertical HOLESTEEL drillers are at work for industry today . . . doing tough peacetime and defense assignments with a maximum speed and a minimum of down time. NATCO machines of all types . . . drillers, borers, tappers and facers are veterans of years of service . . . many NATCO's are now in operation over forty years.



Call a Natco Field Engineer

to help you solve your problems in Drilling, Tapping, Boring and Facing

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Indiana

Branch Offices | *1809 Engineering Bldg., CHICAGO • 409 New Center Bldg., DETROIT*
1807 Elmwood Ave., BUFFALO • 2902 Commerce Bldg., NEW YORK CITY

REDUCE DRILLING TIME!

Get Maximum Cutting Speeds with Infinitely Variable Speed Control

The Alzmetall Upright Drills with high powered motor drives and infinitely variable speeds, produce maximum cutting efficiency—even under the heaviest loads. Speed adjustments can be made while the machine is in operation. The regulating hand wheel and speed indicator are conveniently located on the front of the head.

These ruggedly constructed, precisely built drills have an oil pumping system for flooding all gears and bearings, automatic depth releases, built-in lights for work pieces, and, they can be equipped with coolant and tapping attachments. On the larger machines, the coolant tanks are an integral part of the base.

MODEL AB-5
ALZMETALL 30"
UPRIGHT DRILL

SIZES AND CAPACITIES

	MODEL AB-3	MODEL AB-4	MODEL AB-5
CAPACITY	23"	27"	30"
DRILLING CAPACITY—CAST IRON	7/8"	1-3/8"	2-5/16"
DRILLING CAPACITY—STEEL	3/4"	1-1/4"	2"
MAXIMUM DISTANCE—SPINDLE TO BASE	45"	41"	46-7/16"
MAXIMUM DISTANCE—SPINDLE TO TABLE	25"	19"	22-7/16"
INFINITELY VARIABLE SPEEDS R.P.M.	80-3300	90-900	40-800
MOTOR	1 hp.	3.5 hp.	4.2 hp.
SPINDLE—MORSE TAPER	No. 3	No. 4	No. 4
SPINDLE TRAVEL	4-3/4"	7"	9-7/16"
DIAMETER OF COLUMN	4-1/4"	6-5/16"	8-11/16"
NET WEIGHT	440 lbs.	1330 lbs.	3300 lbs.

FOR MORE INFORMATION ABOUT THESE UPRIGHT DRILLS WRITE FOR CATALOGS

COSA CORPORATION
405 Lexington Ave., New York 17

Your source for all Precision Machine Tools—from Small Bench Lathes to Large Boring Mills

IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

LAP FINISHED SIZES

TO .00004" OR BETTER WITH HIGH SURFACE FINISH

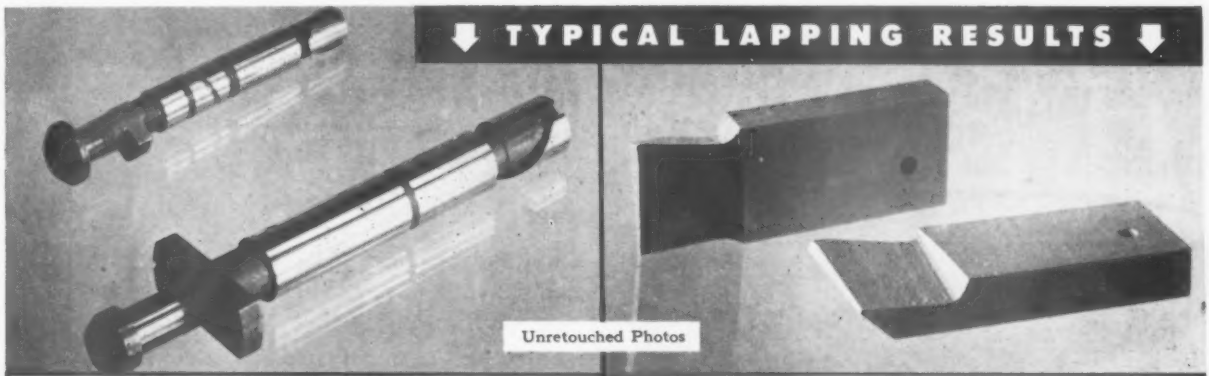
ON WOLTERS EXTERNAL AND FLAT LAPPING MACHINES

Type 2 U 5. Two-wheel Lap with fixture for cyclodial movement of flat, parallel workpieces.

Two CAST IRON Lapping Wheels—both power driven—produce these excellent results on flat and cylindrical workpieces. The movable upper wheel swings out completely for easy loading and can be set eccentrically for relapping wheel surfaces. The lower one can be used independently as a plain flat lap.

SIZES AND CAPACITIES		
	Type 2 U 5	Type 2 U 8
Lap diameter	15"	28"
Space between laps	2"	3-3/16"

TYPICAL LAPPING RESULTS



Unretouched Photos

PISTONS		
Material—Hardened Steel	Rockwell C-62	
Diameter of piston	0.276"	0.551"
Lapping allowance	0.00028"	0.00028"
No. of pieces per load	44	14
Lapping time per piece	0.45 min.	1.0 min.
Surface finish on both	RMS=0.5 micro inches	
Out of Roundness	less than 0.00004"	
Machine used	Type 2 U 5	

BLADES FOR BEVEL GEAR CUTTERS	
Material—High Speed Steel	
Size	2" x 13/16" x 5/16"
Lapping allowance	.001"
No. of pieces per load	42
Lapping time per piece	0.15 min.
Surface finish	3 micro inches
Error of Parallelism	less than .00004"
Machine used	Type 2 U 8

Send us the details of your lapping jobs. Our engineers will gladly recommend the most suitable equipment.

Other WOLTERS Lapping Equipment

• Flat • Hydraulic Internal • Horizontal Internal and External • Universal Lapping Machines • Carbide Tool Grinder and Lapping Machine •

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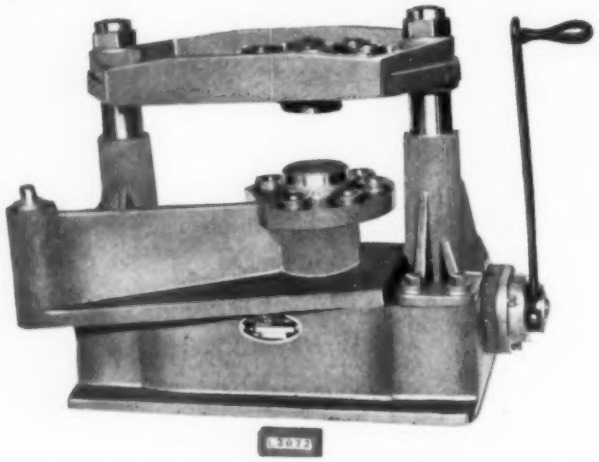
All Types of SHOP PRODUCTION TOOLS

DESIGNERS – BUILDERS



Fixture for line boring six holes in master rod. Part locates on two plugs and is clamped with top plate.

STANDARD FIXTURES AND FIXTURE LOCKS

REPRESENTATIVES:

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Production Tool Co.

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All Sizes, All Diameters

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manufacturers of optical flats and monochromatic lamps . . . mold polishing

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Buol HELICAL SPIRAL TAPER PIN REAMER

featuring

Continuous change in lead angle to compensate for continuous change in diameter.

- This feature insures uniform depth of radial undercut (shear) on the entire length of the taper and provides uniform relief at all points on the diameter.
- In stock for immediate delivery sizes #6/0 thru #10. Made promptly to order sizes #11, 12, 13, and 14.
- Backed by 27 years of manufacturing reamers exclusively. We also make Stub Reamers, Die Clearance Reamers, and Special Reamers to your exact specifications.

MANUFACTURERS' AGENTS: Exclusive territories open outside of New England and metropolitan New York. Write us.

THE BUOL MACHINE CO.
REAMERS EXCLUSIVELY
PARK & MEADOW NEW BRITAIN, CONN.

USE READER SERVICE CARD; INDICATE A-10-204-3

quality steel is more than pride at JESSOP

Steelmaking is a fine art in the Jessop mill. For example, the high alloy steel which went into the tool bits pictured above was produced in a small batch with the greatest of care. Each ingredient was weighed out meticulously. The formula was exactly prescribed according to the specific function of the end product and the melting took place under precise time and temperature control. Extreme quality control is more than a matter of pride-of-accomplishment with Jessop men. They want more customers and they want them to be satisfied. They want Jessop to be known as the absolute leader in the making of special steels. They work hard at it, every day.

HIGH SPEED STEELS • HIGH SPEED BITS • PRECISION GROUND FLAT STOCK HIGH SPEED AND ALLOY SAW STEELS • HOT WORK DIE STEELS • COLD WORK DIE STEELS • CARBON AND ALLOY STEELS • STAINLESS AND HEAT RESISTING STEELS • VALVE STEELS • STAINLESS-CLAD STEELS • CAST-TO-SHAPE STEELS • COMPOSITE TOOL STEELS • ARMOR PLATE

JESSOP

STEEL COMPANY · WASHINGTON, PENNSYLVANIA

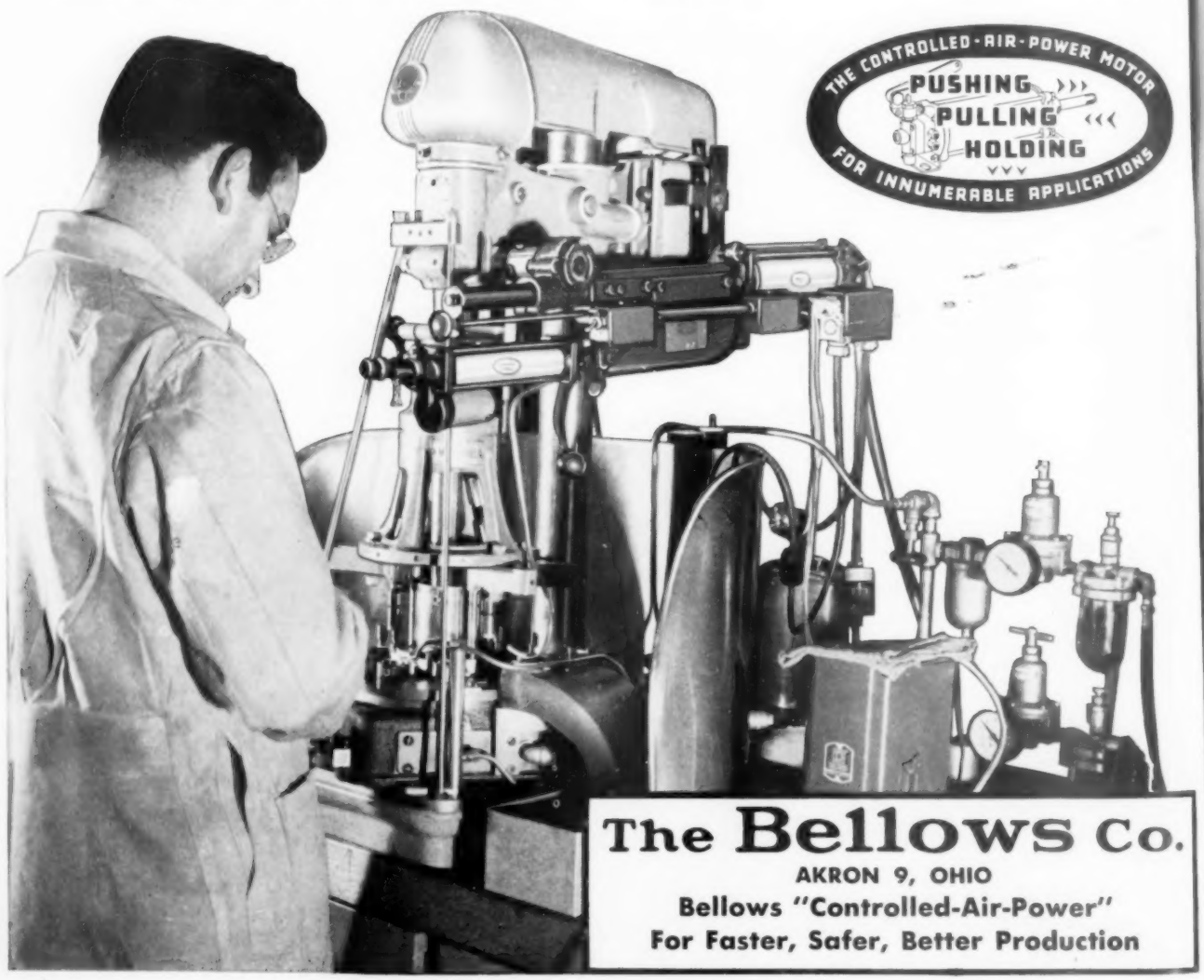
BULOVA WATCH CO. FINDS HIGH ACCURACY–LOW COST–IN MACHINING WITH AIR POWER

HIGHEST standards of accuracy are characteristic of Bulova Watch Company—in product, and in manufacturing processes. Hand in hand with high accuracy goes close cost control, and continual searching for new ways of doing old jobs better.

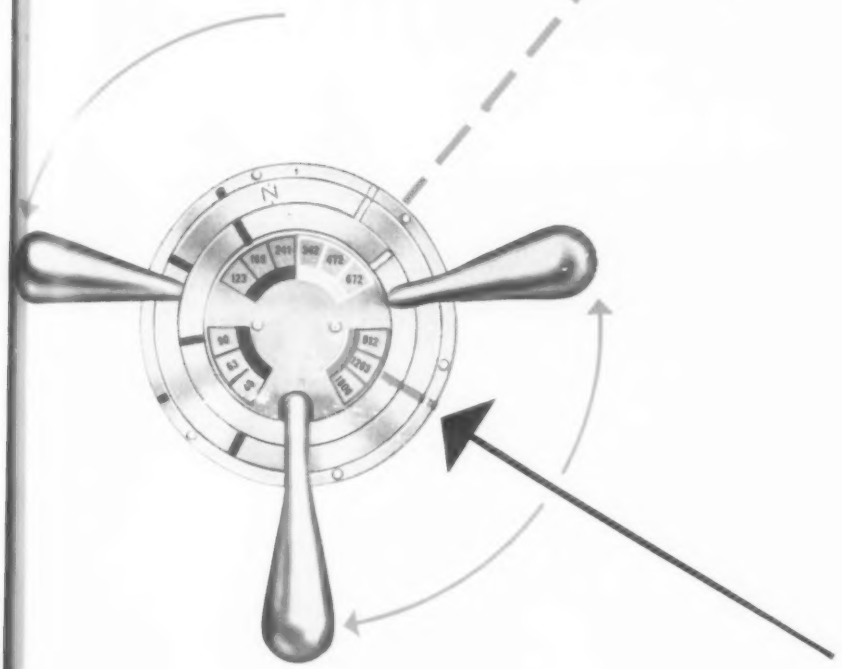
Typical of Bulova's approach to manufacturing problems is their use of Bellows "Controlled-Air-Power" Devices to automatize tedious, costly hand operations. For example, in this set-up for blind hole drilling and counter sinking (a common hand operation), Bulova uses a Bellows Drill Press Feed to feed a multi-spindle drill press, and a Bellows Rotary Work Feeder to position parts under the spindle. Both Bellows units are electrically inter-locked and controlled. The work of the operator is reduced to loading and unloading. Production is a steady 500 per hour and parts are finished to hair line accuracy.

Today, in thousands of manufacturing plants in all lines of industry, alert production men view every repetitive manual operation with a critical eye, asking, "Can we do it better with Bellows 'Controlled-Air-Power' on the job?"

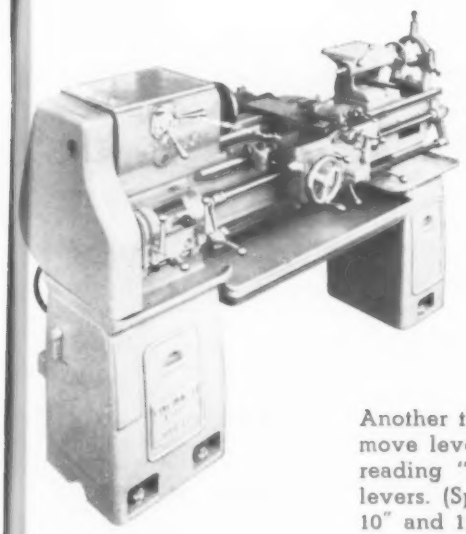
We would like you to see our latest Foto Facts File showing applications of "Controlled-Air-Power" in many of these plants. It's yours, on request, without cost or obligation. Write The Bellows Co., Akron 9, Ohio, and ask for a copy of the current Foto Facts File. 601-A



can you top this pick speed



match color



Another time-saving, production-boosting **plus** in Tray-Top Cintilathes. You simply move levers so the colored lines point to the desired speed marked on the direct reading "color match" dial. No more cross reference between index plate and levers. (Speed shown is 1263 rpm.) All geared head gives you 12 spindle speeds. 10" and 12½" swing sizes, standard range — 30 to 1200 rpm (optional range — 45 to 1800 rpm), 15" and 18" swing sizes, standard range — 20 to 820 rpm (optional range — 30 to 1200 rpm). 40 to 1 overall ratio. Totally enclosed quick-change gear box provides 48 thread and feed changes, and reverse for leadscrew. In less than 15 minutes Tray-Tops with an English leadscrew can be changed to cut a full series of metric threads using the quick-change box in the normal manner. These are just a few extra values Tray-Tops offer at economy prices. Swing sizes: 10", 12½", 15", and 18". Catalog on request.

CINTILATHE

CINCINNATI 9, OHIO, U.S.A.

cincinnati lathe & tool co.

fast!

THE R AND L TAP AND DIE HOLDER

Instant engagement at full contact!

Fast kick out clutch! No spring plungers

to wear or break! No small screws to work loose!

Right to left threading instantly with new release mechanism!

Featured only in The R and L Tap and Die Holder!

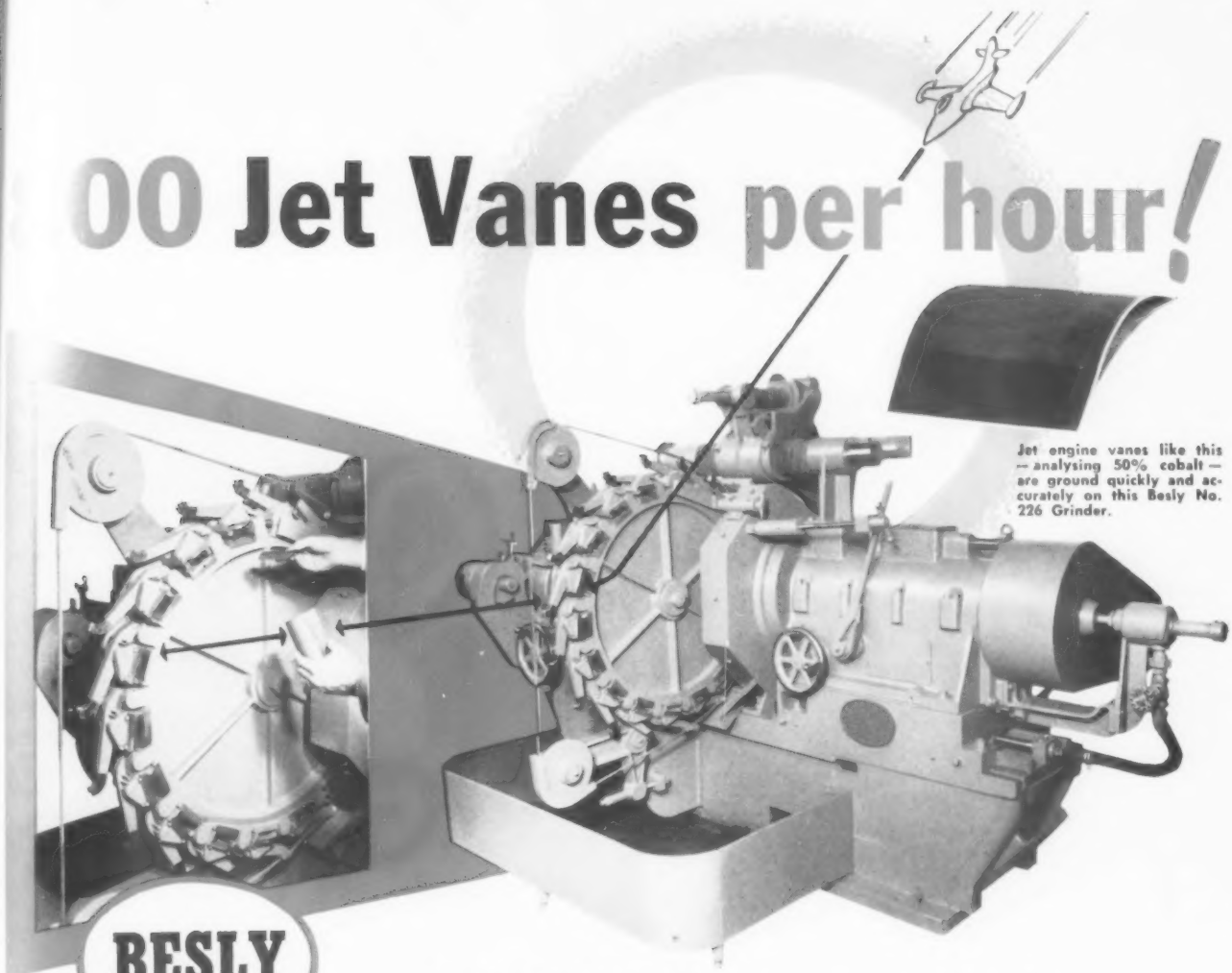
Write for complete catalog of R and L products

RIGHT R and L LEFT TOOLS

1825 BRISTOL STREET • PHILADELPHIA 40, PA.

TURNING TOOL • TAP AND DIE HOLDER • UNIVERSAL TOOL POST • TURRET BACKREST HOLDER • CUT-OFF BLADE HOLDER • RECESSING TOOL
RELEASING ACORN DIE HOLDER • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL • CARBIDE AND ROLLER BACKRESTS

00 Jet Vanes per hour!



Jet engine vanes like this — analysing 50% cobalt — are ground quickly and accurately on this Besly No. 226 Grinder.

BESLY

Jet Engine Vanes ground at high production rate on BESLY 226 Double Spindle Grinders

Each of two No. 226-30" Double Spindle Grinders turns out approximately 800 jet vanes per hour, removing 1/16" and .010" of stock respectively on rough and finish grinding. Each Grinder has a rotary unit and feed wheel with 18 work stations. Blades are loaded by hand, then automatically located and clamped by a cable clamping mechanism. After passing between abrasive wheels where stock is removed from both ends, the work is partially ejected from the station and unloaded by hand.

Important savings are effected in material, weight and cost of production by fabricating Jet Engine Vanes from heat resistant alloy sheet which is formed and welded to the required airfoil.

The above illustration shows one of two Besly No. 226-30" double spindle grinders employed to rough and finish grind the ends of the Jet Engine Vanes. The two open ends of the vanes are ground simultaneously by passing between two parallel abrasive wheels where approximately 1/16" of stock is removed from each end.

Every 4½ seconds a finished ground vane is delivered from these grinders. The difficult fixturing problem of locating and clamping the unusual form was solved with typical Besly skill and ingenuity.

The problem of eliminating heat distortion and burning when grinding tough, thin-wall material was solved by the use of a highly efficient coolant system and the proper abrasive wheels.

This is another example of results achieved when Besly experience applies Besly grinders — either basic, with adaptation or specially engineered — to practically any grinding operation.

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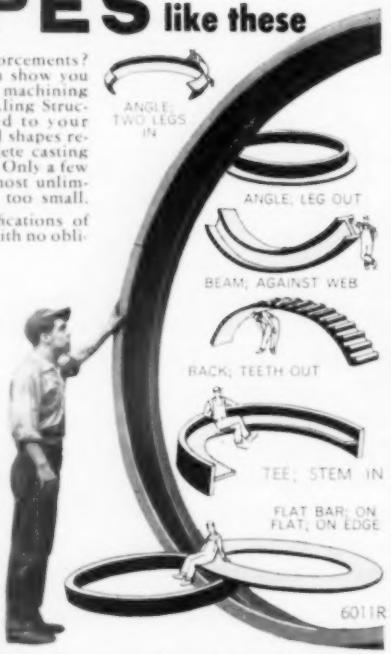

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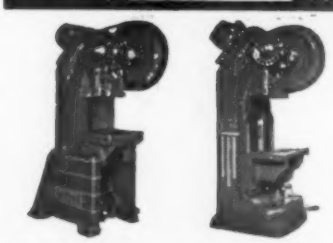

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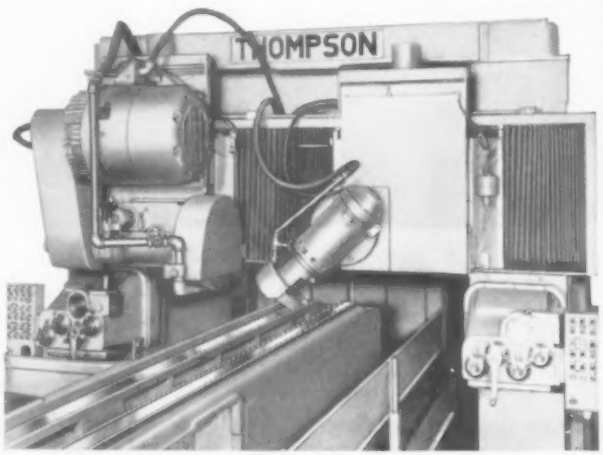
New Thompson Way Grinder Developments

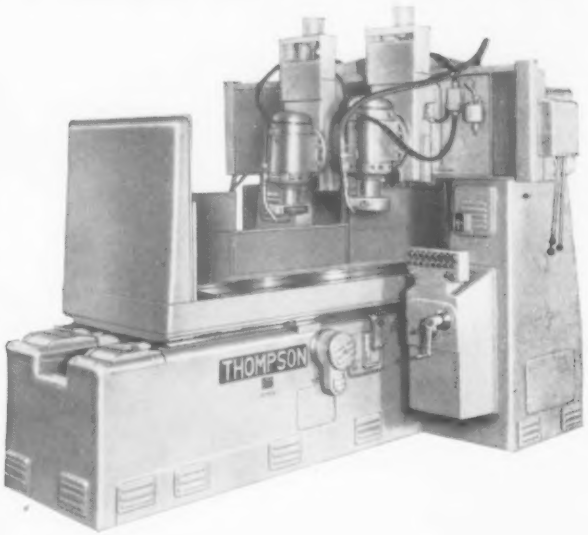
Reduce Costs ... Speed Machine Tool Production

Way Grinders now available with single, multiple heads, or combinations of horizontal and vertical heads and in sizes to meet all requirements.

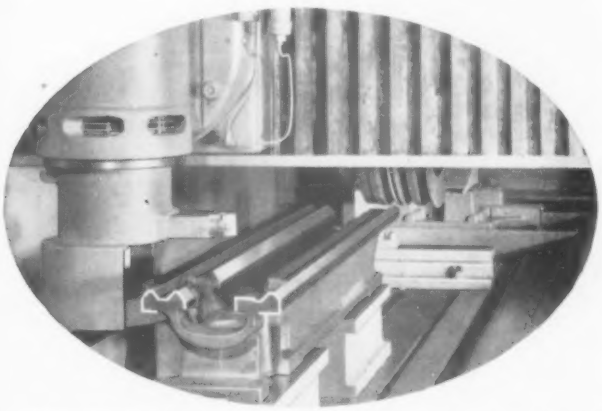
Thompson has produced machine tool way grinders in many types and sizes that have eliminated hand-work and produced economical and accurate ground ways. However, recently increased production grinding of ways has been made possible by many new Thompson Way grinding developments such as: automatic grinding and truing cycles; dual vertical or horizontal heads for grinding ways different heights; horizontal multi-wheel grinding and vertical side and undercutting head; Hydrail way grinding for giant columns or bed ways. Three of the new Thompson Way Grinders are shown here.



Designed especially for extremely large machine tool way grinding is this typical Thompson Hydrail Way Grinder. Size 48" x 48" x 192". Part: grinder bed ways.



One of several new Thompson Double Head Dovetail Way Grinders installed to speed work and hold accuracy in the plant of a leading lathe manufacturer.



Multi-wheel grinding with auxiliary vertical head. Equipped with horizontal spindle having dual spaced wheels and auxiliary inclinable spindle. The front contoured grinding wheel grinds the rear set of ways and the rear grinding wheel grinds the front set, with vertical head grinding the sides and undersurface of the ways and rack seat.

Write for details Today.

Thompson SURFACE Grinders

The Thompson Grinder Company, Springfield, Ohio

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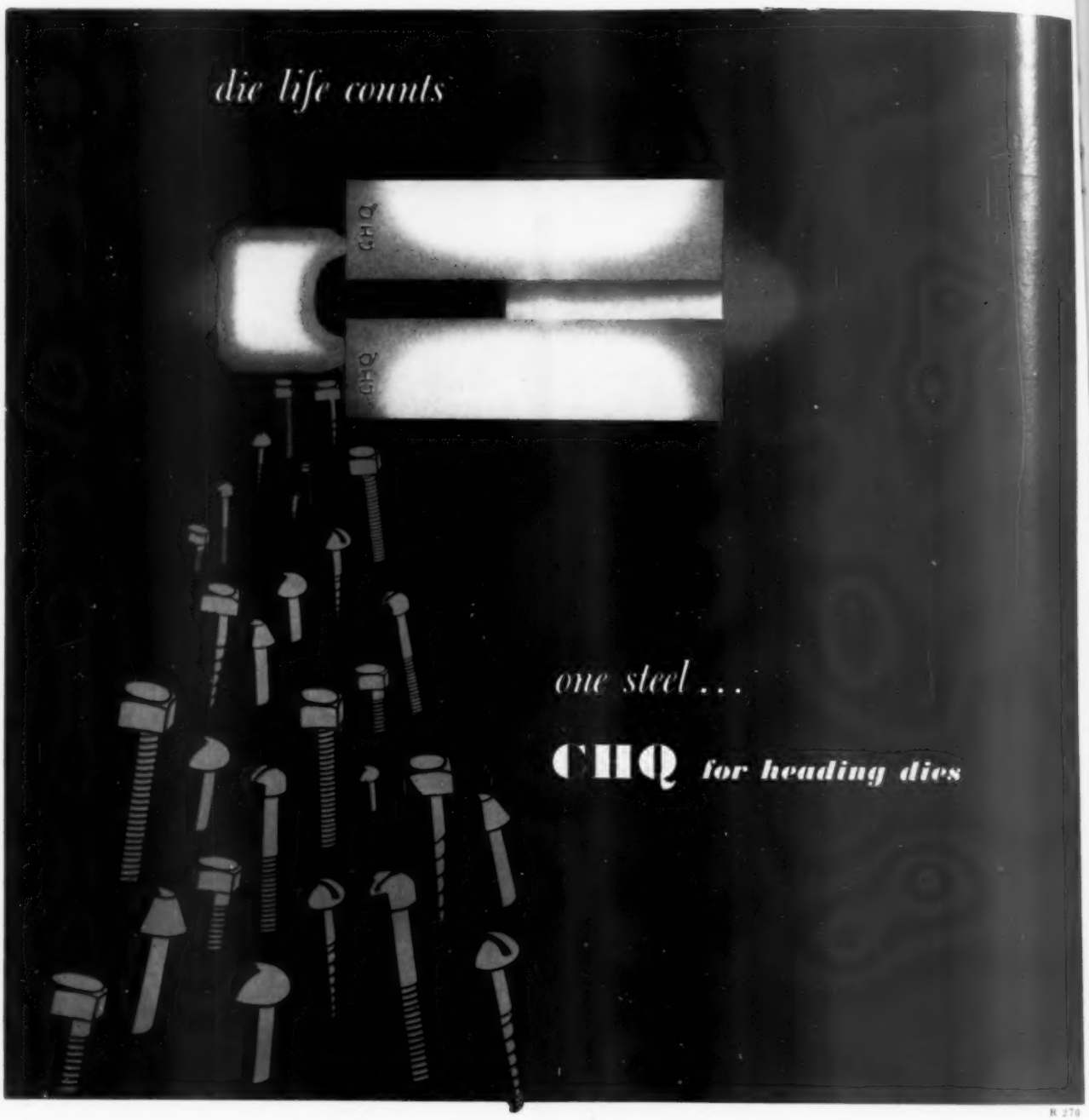

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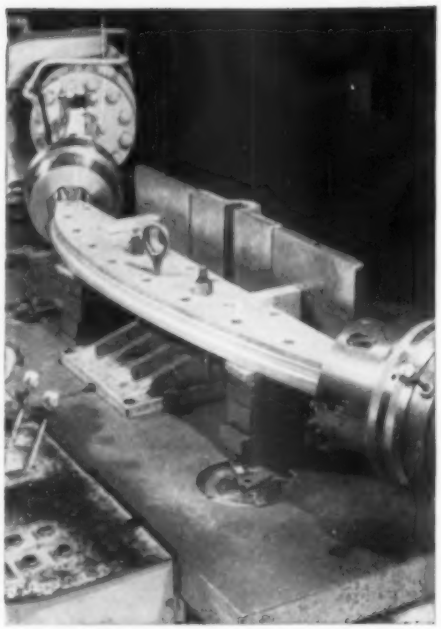

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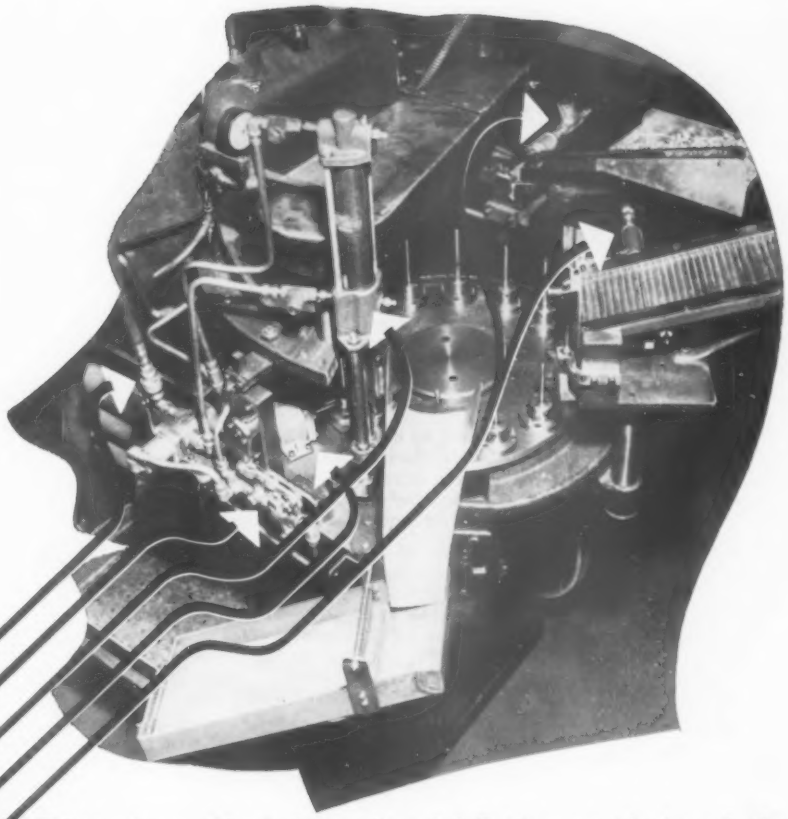

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Schrader Air Cylinders automatically open feeding chutes, to deliver components to the turntable.

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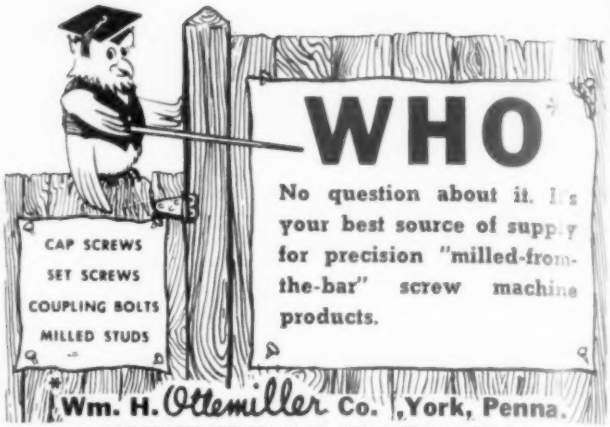

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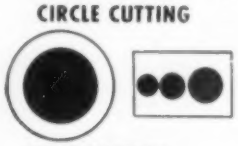

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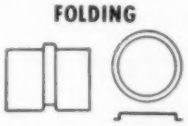

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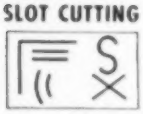

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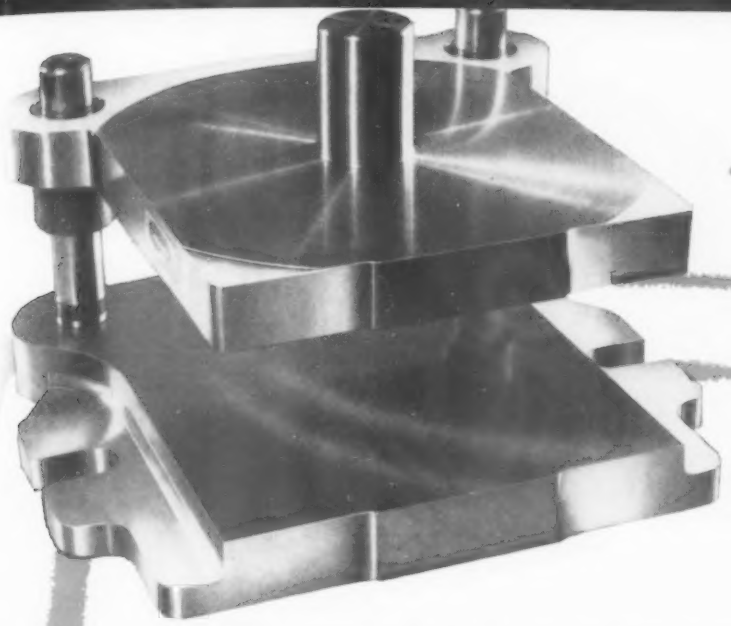

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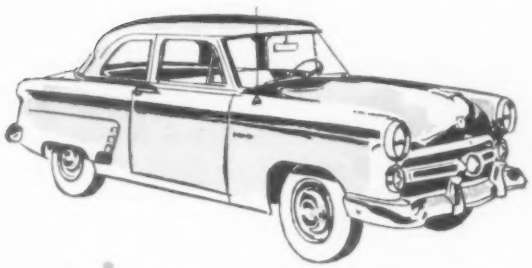

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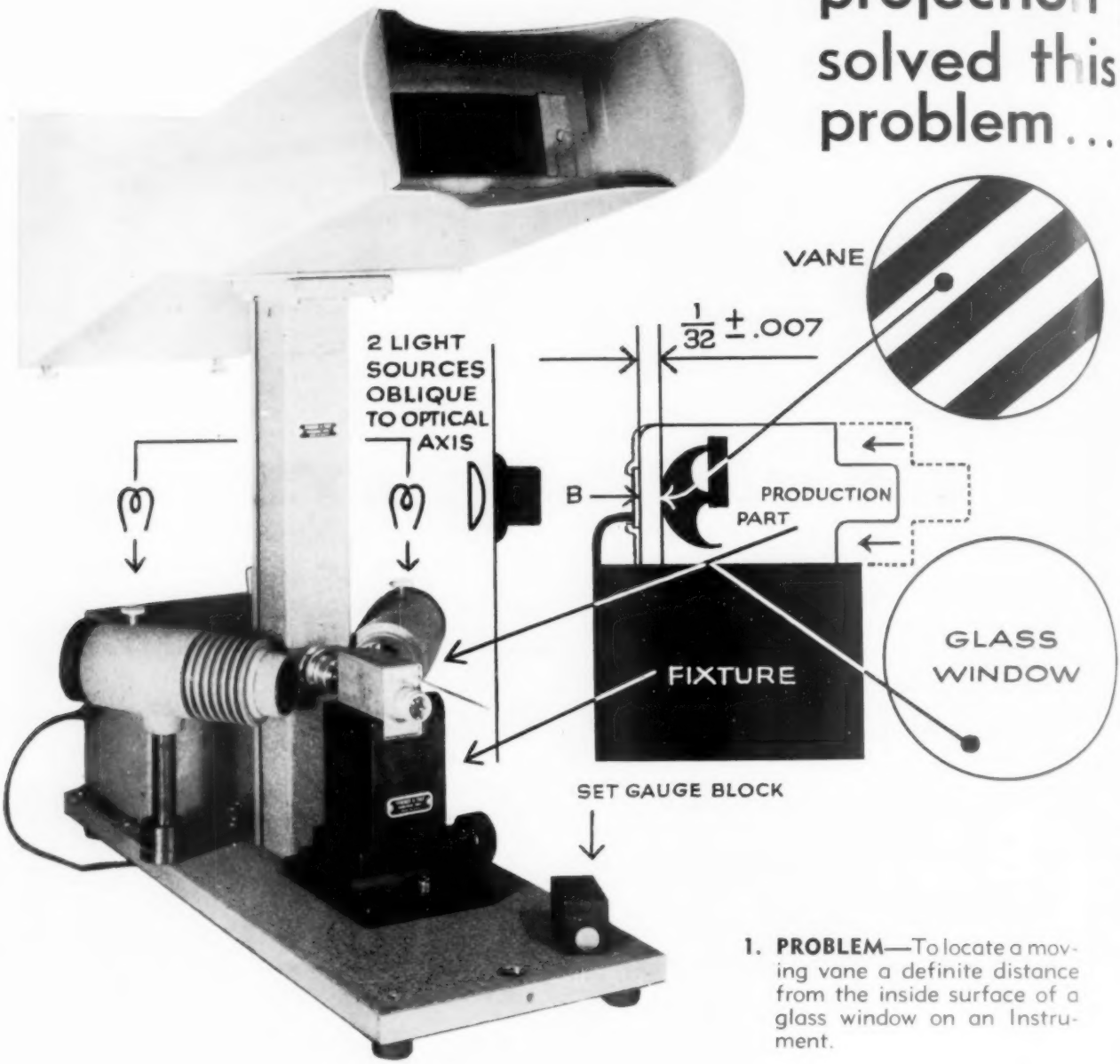

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2. **SOLUTION**—The fixture is first positioned a definite distance from lens system by means of focusing on a Set-Gage Block. Then by placing production piece in fixture the internal part of instrument can be moved into position until it is in clear focus on the screen. By using an oblique lighting attachment an intense beam of light reflects the image of the vane behind the window on to the screen in front-surface projection. The method allows the moving vane to be set within Plus or Minus .007 to the inside of window "B".

3. **OPERATOR TIME CYCLE**—
120 per hour or more depending on skill of operator.

4. **EQUIPMENT NEEDED**—
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5. **COST**—
Less than $1000 including engineering.

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THE IMPORTANT REQUIREMENT

All brands of multiple spindle bar automatics offer value or they would not be on the market. If it were possible to engineer and incorporate the superior qualities of all into one machine, certain features would still be considered more important than others in accordance with the individual buyer's requirements.

But there is one essential quality required of all brands—regardless of the job. It is *dependable, low cost performance!* CONOMATIC users know well its benefits. But you don't have to be a user to know about this feature, or any other feature, of the CONOMATIC. Just write, wire, or phone for the information. There is no obligation.

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A Comparison of ALL Automatics is in favor of Cone

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OK carbide cutters
mill vital "Thunderjet" Forgings
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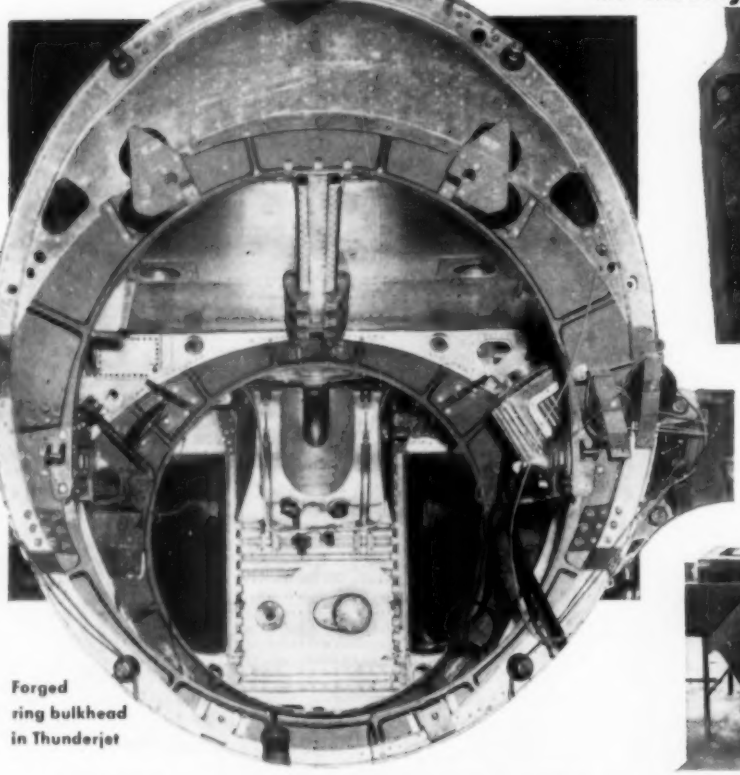
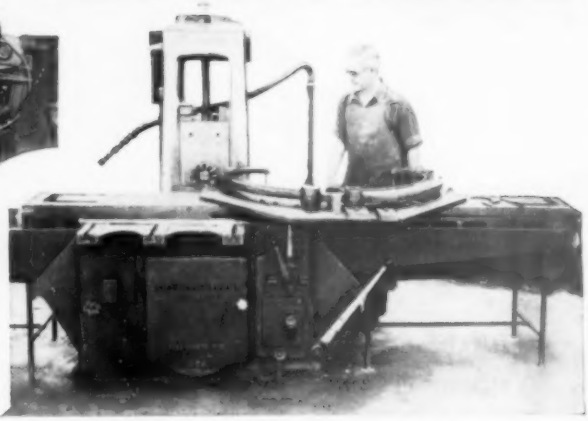


Forged ring bulkhead in Thunderjet



REPUBLIC AVIATION'S F-84 Thunderjet doesn't have room in the fuselage to carry the wing spar straight through. Hence, box-section wing spars must be attached to connection points on either side of a forged-steel ring bulkhead. This assembly literally holds plane together, besides mounting the engine.

To get adequate strength in this vital bulkhead, Republic Aviation specifies a chrome-moly steel heat-treated to 180,000 psi and a hardness of Rockwell 40 C (375 Brinell). In milling abutting ends the two half-ring forgings that are spliced to make the bulkhead, Liberty Products Corporation uses OK carbide-tipped cutters exclusively. In fact, this Farmingdale, L.I. plant has standardized on OK cutters for all of its many milling operations.

In the setup shown, a 6-in. dual-adjustable face mill with negative rake and carbide-tipped blades is being used to finish the ends of an I-section ring forging. Two of these forgings are later spliced top and bottom and an accurate fit is required. Two roughing cuts and one finishing cut are taken on each piece, at a feed rate of 5.5 in. per min. At a spindle speed of 251 rpm., the chip load per tooth figures out at 0.0022 in., which is very good considering the physical properties of the material. Furthermore, 6 pieces are produced per cutter grind.

Like Liberty Products, you too can enjoy the advantages of standardizing on OK cutters. The wedge-shaped blades require no locking devices of any kind and are easily removed when necessary. *Blade slots are machined true*, so that the assembled cutter cuts cleanly without any vibration to produce the smooth finishes so essential in aircraft work and elsewhere. To reduce inventory costs, blades are standardized and interchangeable with other designs of OK cutters. You have a choice of carbide, cast-alloy or high-speed steel blades as you prefer.

See for yourself why experienced shop men, at Liberty Products, in machine tool plants and elsewhere stock and use OK cutters exclusively. Write for new catalog "Modern Milling Cutters for Modern Milling Machines."

OK modern milling cutters for modern milling machines

THE O K TOOL COMPANY, MILFORD, NEW HAMPSHIRE

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-222

Quick JOB CHANGES WITH GREENLEE automatics

Injector plunger part machined on a 2-inch Greenlee Six from C-1117 bar stock in 59 seconds, to tolerances of 0.002". Former machining time was 3 to 4 minutes per piece on single-spindle equipment.

...INCREASE PROFITS FOR MITCHEL AND SCOTT

The quick change-over features of Greenlee Automatics . . . standardized, interchangeable tool holders, simplified cross-slide camming, rapid stroke-setting arrangement, built-in threading drive, and other important characteristics make them equally adaptable for short or long-run applications.

The Mitchel and Scott Machine Company, Inc., of Indianapolis, Indiana, operate seven Greenlees . . . using them in producing a wide variety of job-shop work. Some of the jobs, such as the one illustrated, run as few as 2000 pieces . . . so set-up time must be reduced substantially to make them show a satisfactory profit.

PRODUCTION MACHINERY
GREENLEE

★ If your production schedules are cramped by long, costly set-ups, we'll be glad to make recommendations.

GREENLEE BROS. & CO. 1990 MASON AVE. ROCKFORD, ILLINOIS

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

Van Keuren

MEASURING ROLLS

are just the thing for the precise measurement of

DOVETAILS
V GROOVES
AND ANGLES

Inspection set No. 17 Measuring Rolls, complete in mahogany case $212.75. Set No. 17 contains 2 rolls each of sizes:—

.050	.0625	.100	.125	.150	.1875	.200	.250	.300
.400	.500	.600	.700	.750	.800	.900	1.000	

All rolls are 1" long and are guaranteed to be within .00002" for roundness, straightness and exact size.

Complete details on this and other Precision Measuring Tools are given in the Van Keuren 1952 Catalog and Handbook No. 35.

● *WRITE FOR YOUR COPY*

THE Van Keuren CO., 174 WALTHAM STREET, WATERTOWN, MASS.

33rd YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Snap Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires

PIONEERS IN THE ART OF DESIGNING AND PRODUCING CARBIDE TOOLS
A PRODUCT IS KNOWN BY THE COMPANY IT KEEPS
GMC TRUCKS
Mack TRUCKS
WRIGHT AERONAUTICAL
GM DIESEL POWER
Ford
CHEVROLET
CATERPILLAR
INTERNATIONAL HARVESTER
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FORD
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Plymouth
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MINNEAPOLIS MOLINE MODERN MACHINERY
GENUINE Budd WHEEL
WESSON COMPANY
FERNDALE (DETROIT 20), MICH.
Affiliated with
WESSON METAL CORPORATION
YOU'LL GET MORE WORK OUT OF WESSON METAL AND WESSON TOOLS
WESSON
Carbide Cutting Tools
First choice when tough metals are to be cut—
for special or standard purposes—
for single or multiple set-ups.

A WEEK'S FINISHING DONE IN A DAY

HAYNES STELLITE alloy milling cutter blades recently solved a tough finishing problem in the production of cast iron mold jackets. Face-milling operations with harder tool materials failed because of chipping and spalling of the cutter blades after finishing only a few castings. Then the foundry tried grinding the jackets. But this was too slow; it took at least 30 minutes to grind each one.

A switch to HAYNES STELLITE Star J-Metal blades cut finishing time to a mere six minutes per casting. An extra saving results from the long life of the HAYNES STELLITE alloy blades. They produce about 350 pieces per grind.

HAYNES STELLITE alloy tools are ideal for cast iron milling jobs because of their high compressive strength at cutting temperatures, good impact strength, and extremely low co-efficient of friction. Contact our nearest District Office for on-the-job help with your machining problems, or write for the new manual, "HAYNES STELLITE Metal-Cutting Tools."

This 12-in. diameter cutter, containing 32 HAYNES STELLITE alloy inserted blades, removes 1/16-in. of stock from cast iron mold jackets. A 36-in. casting is milled with this setup in about 1/5 the time required for grinding.

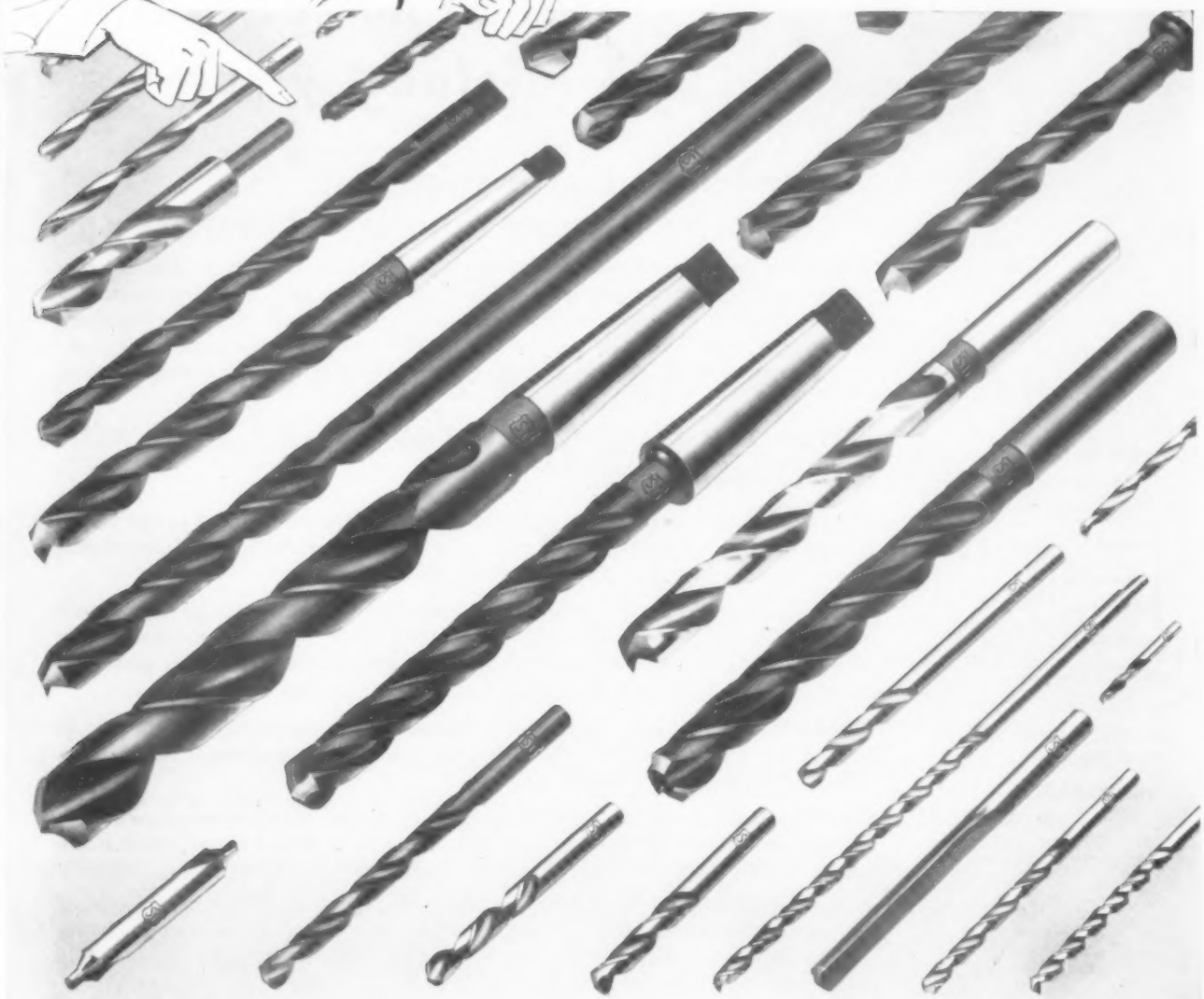
HAYNES TRADE-MARK *alloys*

"Haynes" and "Haynes Stellite" are trade-marks of Union Carbide and Carbon Corporation.

Haynes Stellite Company
A Division of
Union Carbide and Carbon Corporation
UCC
General Offices and Works, Kokomo, Indiana
Sales Offices
Chicago — Cleveland — Detroit — Houston
Los Angeles — New York — San Francisco — Tulsa

"Doc" *Red Shield* says:

"Cure production ills with STANDARD DRILLS"



STANDARDIZE AND SAVE WITH STANDARD RED SHIELD METAL CUTTING TOOLS. THERE IS A STANDARD DISTRIBUTOR NEAR YOU AND READY TO SERVE YOU.

STANDARD TOOL CO.

3950 CHESTER AVENUE
CLEVELAND 14, OHIO

STANDARD TOOL CO.

New York • Detroit • Chicago • Dallas • San Francisco

THE STANDARD LINE: ***Twist Drills • Reamers • Taps • Dies • Milling Cutters • End Mills • Hobs • Counterbores • Special Tools***

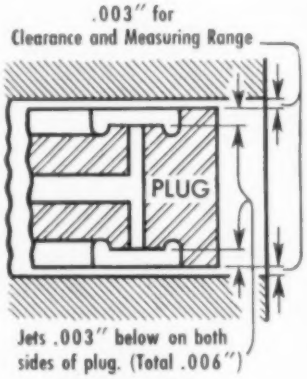
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-227

You Use Only ONE MASTER with the DIMENSIONAIR!

Don't let custom mislead you . . .

The magnification is fixed . . . that is why its scale can be calibrated.

Both the Dimensionair and the master ring are constant. Only the dimension of your *workpieces* can vary. Because the Dimensionair is a precision measuring instrument with a constant scale value, only a single master is required to check the zero location. Don't let past customs mislead you. The Dimensionair is the only air gage built with enough precision to permit you to use a single master.



MORE RANGE
MORE WEAR

When the Plug Wears You're Still Safe with the Dimensionair.

FIRST. This is so because the Dimensionair's greater measuring range allows greater clearance which in turn results in less plug wear. (The Dimensionair Range is .003" on a 2500 to 1 magnification.)

SECOND. Only jet wear can change calibration. Dimensionair jets can't wear because they are deeply recessed into the plug body. (On Dimensionair Plugs each jet is .003" below the plug surface.) Hence, a plug can be worn a great deal more than usual without any fear of wearing into the face of the jets.

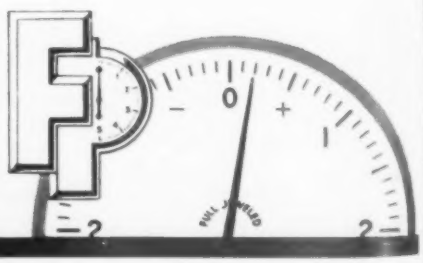
THIRD. When a plug eventually wears to the danger point you will be warned because the gage will clearly show that the readings are no longer stable when you test the plug in the master ring.

FOURTH. Because the jets are located so much deeper than has been customary, they are protected from damage and because the jet holes are larger, there is less danger of the holes becoming clogged with dirt.

A single master is common practice in using Dial Indicators and other types of precision indicating gages. The inherent precision of the Dimensionair makes it possible for you to continue this practice. Those who already own Dimensionairs find this to be true. It is worth your while to learn how satisfactory it is to use the Dimensionair. FEDERAL PRODUCTS CORPORATION, 1910 Eddy Street, Providence 1, Rhode Island.

FEDERAL

Largest manufacturer devoted exclusively to designing and manufacturing *all types* of DIMENSIONAL INDICATING GAGES



COMPLETE VARIETY OF

SIZES AND LENGTHS IN

UNIVERSAL SUPER FINISHED DRILL BUSHINGS

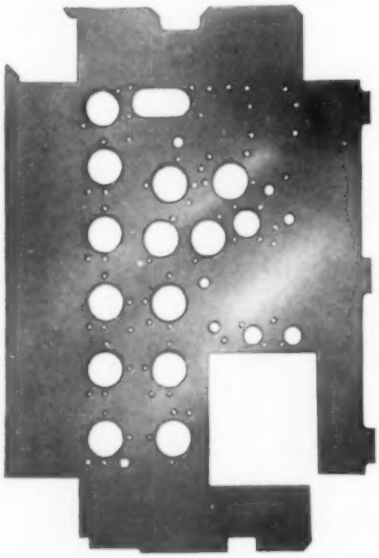
Check these features that make Universal drill bushings outstanding: 1. Super finish reduces wear to a minimum. 2. Blended radius reduces tool hang up. 3. 100% concentricity and hardness tests assure accuracy. 4. Knurled head provides quick sure grip. Order from the office nearest you . . . 1060 Broad St., Newark, N.J., 5035 Sixth Ave., Kenosha, Wis., or write direct to our home office.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-229

how would you produce these jobs?

IN THESE QUANTITIES

850 PIECES
SIZE: 11½" x 17" x .040" thick



TIME: 4.5 minutes per piece

25 PIECES
SIZE: 8" x 10"

TIME: 55 seconds each floor to floor including set-up

75 PIECES
SIZE: 47" x 20¼" x ¼" thick

TIME: 6.2 minutes each floor to floor including set-up

IN THESE TIMES *(including set-up)*

without *LAYOUT* *BURNING* *DRILLING* *MULTIPLE HANDLINGS* *STRAIGHTENING TIME* *FLY CUTTING*

and at absolute minimum tool cost

These jobs, times, and costs are typical—users of Wiedemann Turret Punch Presses are meeting these figures every day—day in and day out.

Why not write for a Wiedemann Analysis and Data Sheet for recommendation on your pierced work? No obligation.

NO JOB TOO LARGE . . . NO RUN TOO SMALL

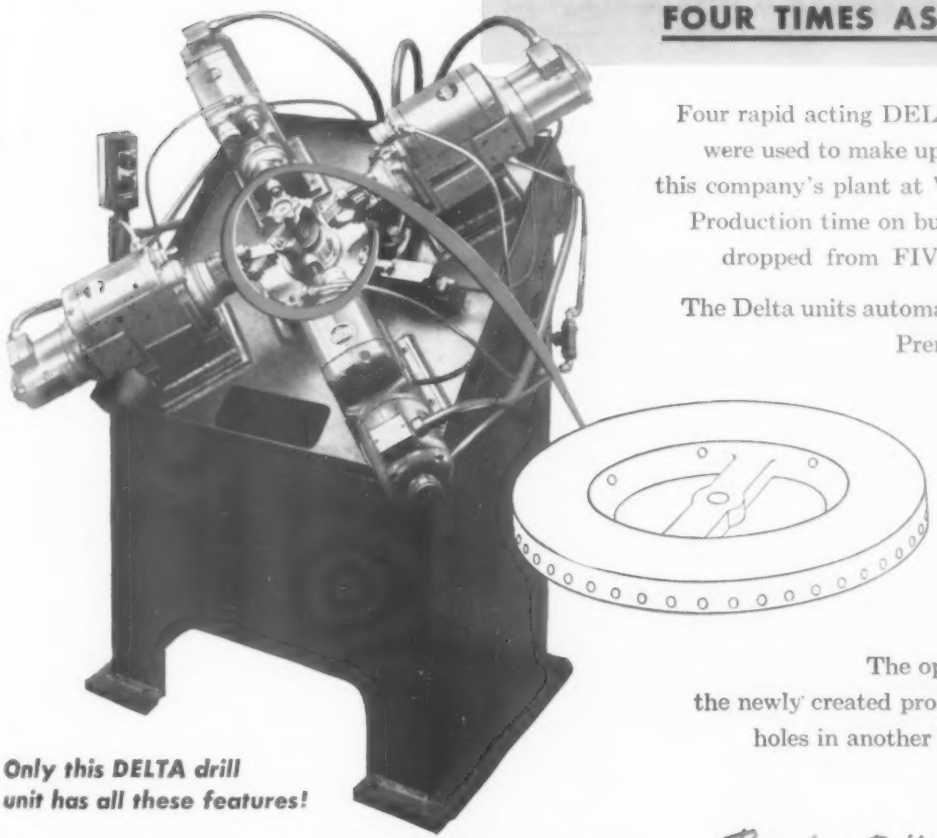
WIEDEMANN MACHINE COMPANY

4272 WISSAHICKON AVE • PHILADELPHIA 32, PA.

Stove Maker Boosts Production 400%

with the NEW DELTA Air POWERED Hydraulic DRILL UNIT

PRENTISS-WABER PRODUCTS COMPANY
Now Drills Gas Stove Burner Cap Holes
FOUR TIMES AS FAST!



Four rapid acting DELTA Model 19-150 Drill Units were used to make up a special-purpose machine at this company's plant at Wisconsin Rapids, Wisconsin. Production time on burner cap drilling immediately dropped from FIVE minutes to ONE minute!

The Delta units automatically drill 48 No. 37 holes in Prentiss-Waber's standard burner caps in 0.94 minutes, and 56 holes in their giant burner caps in 1.01 minutes. After the part is loaded, the machine automatically completes 12 consecutive cycles of drill, index, drill and index—then stops itself. The operator in the meantime using the newly created production time, drills six No. 37 holes in another burner cap!—a free operation any way you look at it . . .

Only this DELTA drill unit has all these features!

- **HYDRAULIC FEED** . . . quickly adjusted, infinitely variable—no recamming or changing lead screws to alter feed.
- **RAPID TRAVERSE** . . . quick, accurate, positive control—no over-travel; reduces tool breakage. Approach consistently at 5 to 6 inches per second to within .010 inch of work.
- **DEPTH CONTROL** . . . quick, accurate, positive—no over-travel; repeats depth consistently to within .0005 inch.
- **UNIVERSAL MOUNTING** . . . units can mount in any position.
- **AUTOMATIC CYCLING** . . . built-in cycle control switches provide for full electrical remote control. Eliminates installing external switches. Drilling units positively electrically interlocked with automatic indexing table.
- **SPECIAL SPINDLES** . . . drive arrangements and other features are available at slight additional cost, including new two-way valve to permit spindle to function with normal rapid retraction or to back feed, as desired.

Two sizes—capacities up to 5/16-inch diameter drill and 5/8-inch diameter drill.

DELTA TOOLS
Another Product

There's a Delta Power Tool for Your Job-
WOOD OR METAL WORKING

53 Machines • 246 Models • More than 1300 accessories

DELTA POWER TOOL DIVISION
DELTA MILWAUKEE Rockwell
MANUFACTURING COMPANY
620L N. Lexington Ave. • Pittsburgh 8, Pa.

☐ Please send the name of the nearest Delta Drill Unit Authorized Representative
☐ Please send me new Drill Unit Catalog

Name_____
Position_____
Company_____
Address_____
City_____ Zone_____ State_____

The Inside Story of WALES Fabricators

Quick change punches and dies in *7 seconds* . . . a complete set of 36 graduated punches (from 3/32" to 1-1/14") and corresponding dies for various thicknesses of material . . . adjustable finger stops with built-in scale for quick gaging of the work . . . *no templates required* . . . and the simplicity of Wales Fabricator design makes possible startling "never-heard-of-before" time study figures.

Wales Exclusive Hydra-New-Matic Drive is unique in its simplicity of design and operation . . . so unique, in fact, that vibration and noise are practically eliminated at 165 strokes per minute.

Write *today* for packet of time studied parts and fully-illustrated, functionally-colored Catalog 10-A.

WALES-STRIPPIT CORPORATION

George F. Wales, Chairman

393 **PAYNE AVE., NORTH TONAWANDA, N. Y.**

(Between Buffalo and Niagara Falls)

Wales-Strippit of Canada Ltd., Hamilton, Ontario

Specialists in Punching and Notching Equipment

HYDRA-NEW-MATIC HEAD operates with a minimum of vibration and noise at 165 strokes per minute.

NO BENDING STRESS ON DRIVE SHAFT. Full-floating drive shaft construction places ram load, by means of main bearings, directly on frame proper.

14-DRAWER CABINET holds punch assemblies and dies.

BUILT-IN COUNTER automatically totals strokes of ram.

NON-REPEAT TRIP LEVER releases ram instaneously for down stroke.

NIBBLE LEVER controls non-repeat device for continuous, uninterrupted operation of ram for nibbling.

FULL-SWING ELECTRIC LIGHT with shield puts light where each job needs it most.

ONE-PIECE STEEL CASTING FRAME is scientifically designed to have maximum rigidity.

WIDE, UNOBSTRUCTED BED TABLE is at the correct height for easy feeding or for the operator to sit down.

ADJUSTABLE FOOT TRIP MECHANISM provides dual control for use when both hands are required to feed the work.

FULL-SIZE DOOR provides unobstructed accessibility to rear of press.

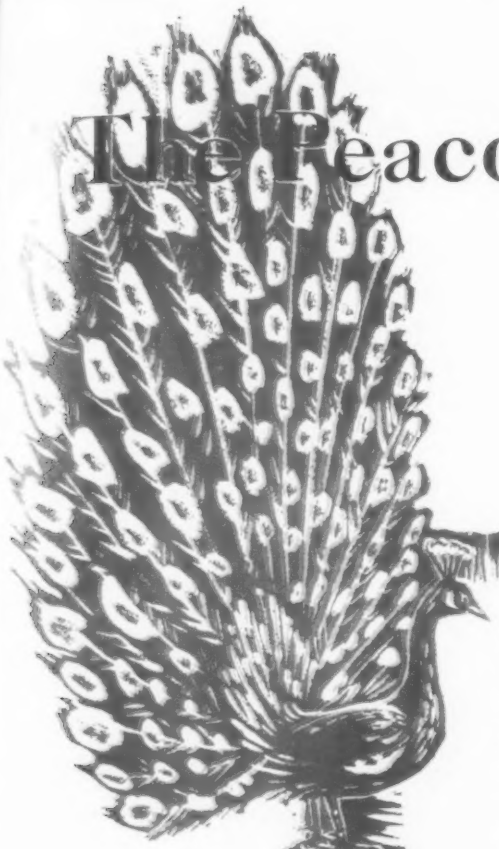
MULTI V-BELT DRIVE from motor pulley to flywheel.

SLUG CLEARANCE TUBE directs slugs to an out-of-way container.

MOTOR MOUNT adjustable to take up slack in V-belts.

The Peacock's Complaint"

has a moral for Cutting Fluid users



Aesop's Story:

Among the fables of Aesop, is the story of the Peacock that lamented to the Goddess of the Birds its inability to sing like the Nightingale. Finally, losing patience, the Goddess rebuked the magnificent bird, saying, "Peacock, none of us can have *all* the fine qualities. The Nightingale is musical, the Eagle is powerful, the Owl is wise, while you are most beautiful of all the birds. Be content, for had you the voice of the Nightingale, you could not have your own beauty."

The Moral:

Just as the Peacock in Aesop's fable excelled in beauty of plumage but not of voice, so does no single cutting fluid excel in every desired characteristic.

For example, in machining tough, stringy materials, a cutting fluid must have high anti-weld characteristics to prevent scuffing and resultant poor surface finish. However, on free machining materials the anti-weld requirement must be balanced for maximum tool life consistent with desired finish.

The fable simply points up the fact that there is no *universal* cutting fluid to give best results on every job.

The Stuart Oil Co. and its representatives offer you no compromise products. They are prepared to help you correctly select and apply the cutting fluids that will give you the best possible results on *your* particular work.

More Than a "Coolant" is Needed

D. A. Stuart Oil Co.
EST. 1865 LIMITED

TIME-TESTED CUTTING FLUIDS AND LUBRICANTS

2727-49 S. Troy St., Chicago 23, Ill.

SEND FOR BOOKLET entitled *More Than a "Coolant" is Needed*

CLIP TO YOUR COMPANY LETTERHEAD AND MAIL

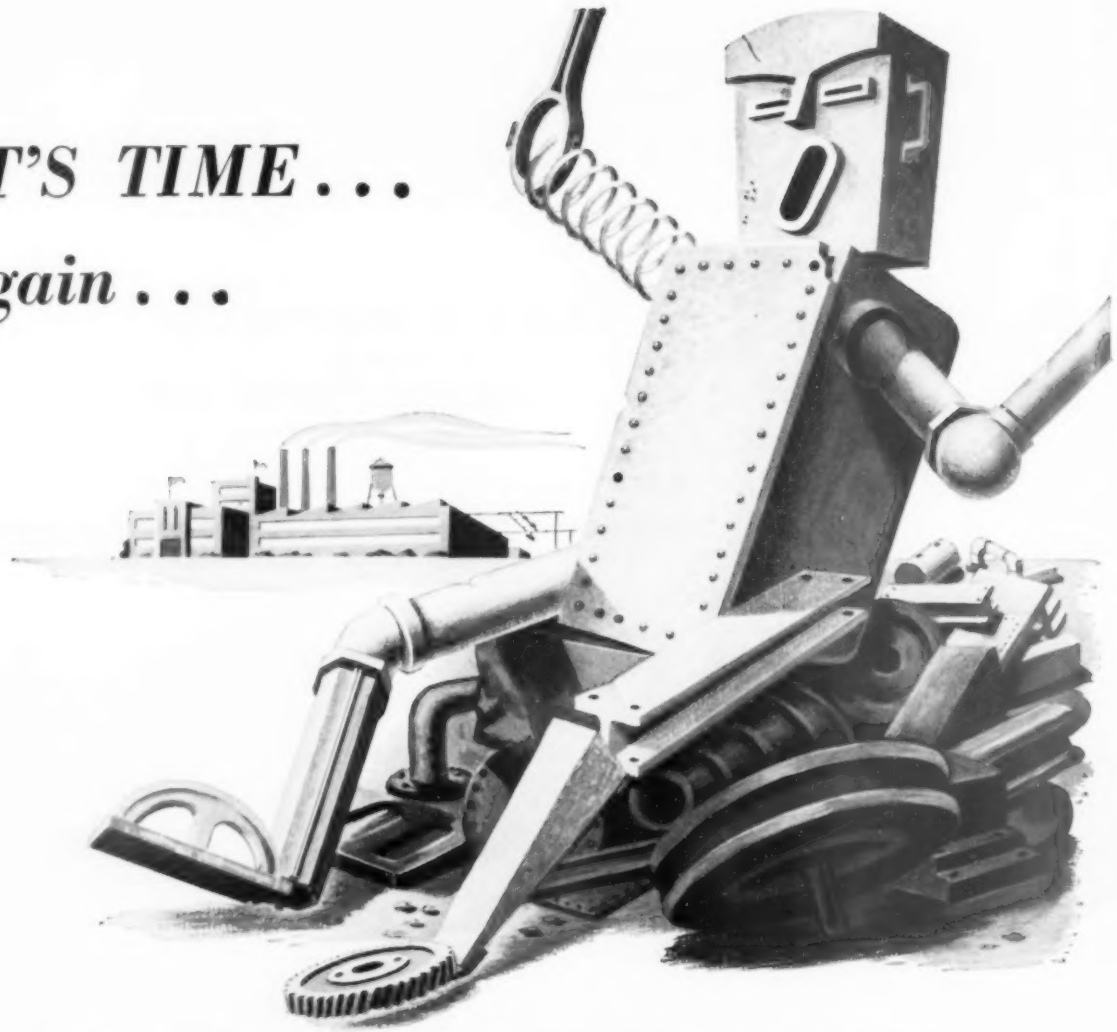
to D. A. Stuart Oil Co., Ltd., 2727-49 S. Troy St., Chicago 23, Ill.

Your Name .....

Title .....

IT'S TIME . . .

again . . .



TO WAKE UP SCRAPPY!

Scrap's getting scarce again . . . compared to the amounts we need . . . and it's up to *all* of us to *help* produce enough steel.

107,000,000 tons of steel is the present rate of production in 1951 . . . 119,500,000 tons is expected in 1952.

Last year, 1950, we produced 97,800,000 tons.

All that extra steel—enough to take care of *both* military and civilian needs—calls for *more scrap iron and steel.*

Scrap Inventories Are Alarmingly Low

While steel mills are producing at a greater rate than ever, scrap inventories have dwindled. Many mills are operating on a hand-to-mouth basis with shut-downs threatened unless we furnish more scrap.

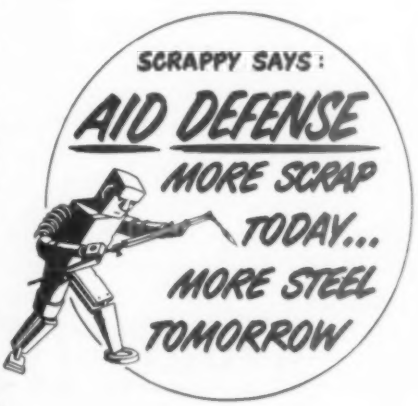
We *do* have the scrap. It's everywhere, not just in the form of *production* scrap—the "leavings" of machining, normally turned over to scrap dealers . . . but also in the form of *idle* metal: obsolete machines and tools, no-longer-usable jigs and fixtures, gears, chains, pulleys, valves, pipe, abandoned steel structures, etc.

We must have this *idle* metal to keep the furnaces running.

Please cooperate. Set up a Scrap Salvage Program in your plant—*now.* For a complete plan on "how to do it", write for booklet "Top Management: Your Program for Emergency Scrap Recovery". Address Advertising Council, 25 W. 45 Street, New York 19, N. Y.

Why Do We Need *Scrap?*

Steel is made half from pig iron, half from scrap. With production on the increase, more scrap must be purchased. And it's up to you to "dig it out" and sell it.



NON-FERROUS SCRAP IS NEEDED, TOO!

This advertisement is a contribution, in the national interest, by

AMERICAN SOCIETY OF TOOL ENGINEERS

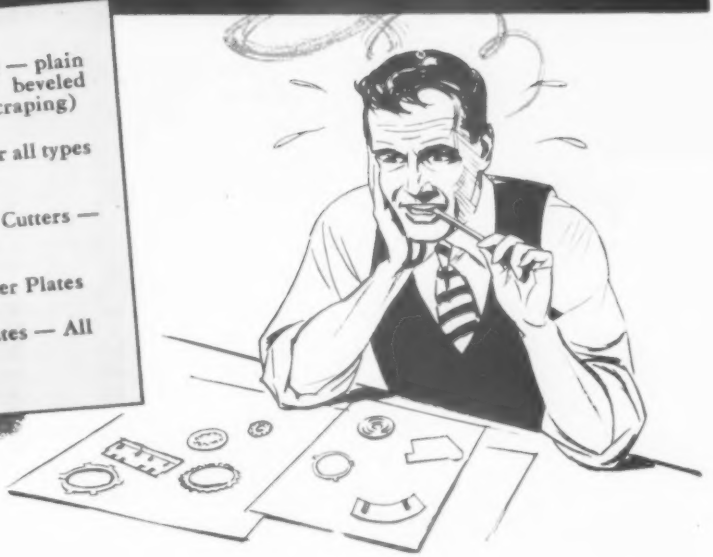
10700 Puritan Ave. Detroit 21, Michigan

A PUBLIC SERVICE PROJECT · THE ADVERTISING COUNCIL

If Parts Like These are Production Headaches..

then make SIMONDS Special Parts Division part of your own production line!

- Heat Treated Discs — all types
- Valve Discs (Compressors)
- Clutch Discs (Multiple Disc Type)
- Aircraft Engine Discs
- Machine Parts (Flat Steel)
- Wear Plates (Ways, etc.)
- Blades — All types — plain — toothed — beveled (For cutting or scraping)
- Circular Cutters for all types of cutting
- Irregular Shaped Cutters — All types
- Heat Treated Liner Plates
- Rectangular Plates — All types



Factory Branches in Boston, Chicago, San Francisco and Portland, Oregon.
Canadian Factory in Montreal, Que.
Southern Service Shop in Meridian, Miss. (formerly J. H. Miner Saw Mfg. Co.).
Simonds Divisions: Simonds Steel Mill, Lockport, N. Y.,
Simonds Abrasive Co., Phila., Pa. and Arvida, Que., Canada

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-235

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October, 1952

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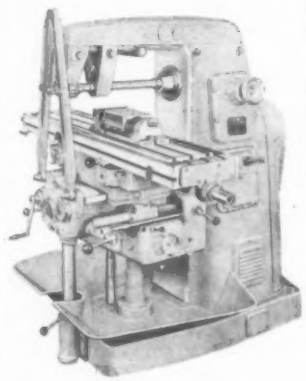
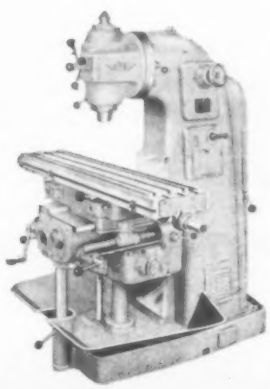
For Toolroom & Production Work



These HERCULES #2 Milling Machines have hardened and ground gears, power rapid traverse in all directions, 12 spindle speeds and feeds, separate oil circulation for main gearbox and feed gearbox, motor in the base, spindles have #50 Standard Milling Machine Taper. Knee rigidly supported by round outboard sliding column.



Work table overall.....12" x 51"
Automatic long feed in.....32
Spindle speeds RPM.....40-900
Main motor HP.....5
Feed motor HP.....1

PROMPT DELIVERY

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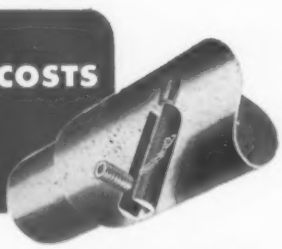

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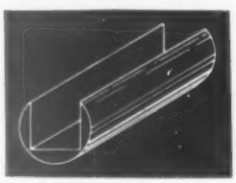

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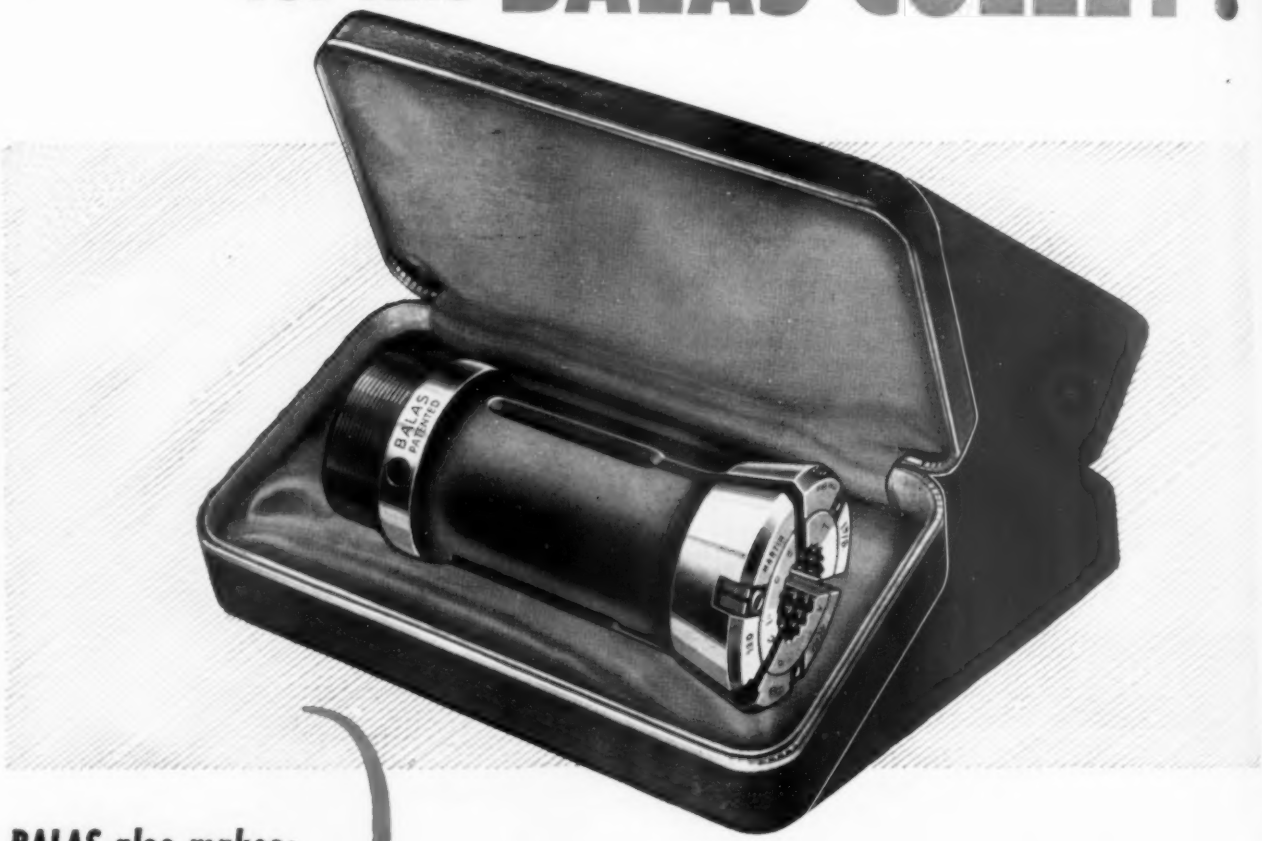

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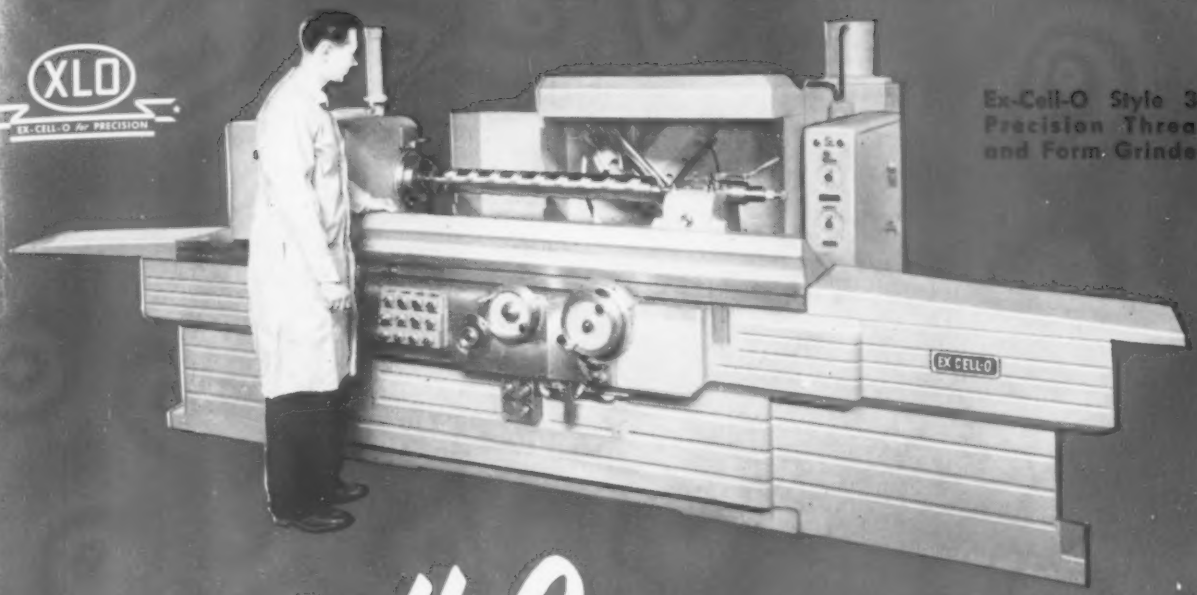

Ex-Cell-O Style 36 Precision Thread and Form Grinder.

Ex-Cell-O Thread Grinders

Ex-Cell-O Style 33 Automatic Precision Thread Grinder.

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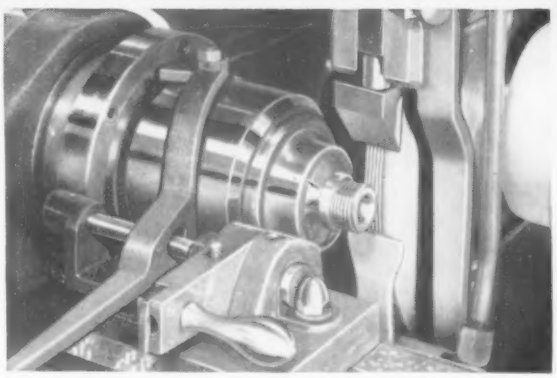

Threading gun barrels on a Style 33 Thread Grinder with multiple rib wheel.

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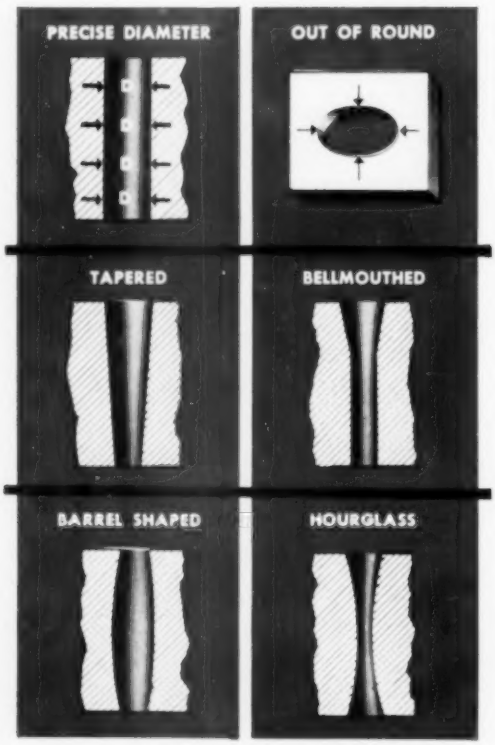
SHOW YOU WHAT PLUG GAGES CAN'T

—and wear 10 to more than 100 times longer!

A PRECISIONAIRE STANDARD SPINDLE SHOWS WHETHER A HOLE IS:



A Precisionaire and *standard* spindle shows you instantly whether a hole is dimensionally O.K.—and, if not, *what* the error is, *where* it is, and *how* much.

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